

**PHASE II/IVA
TASK 2A(1)-DRAFT
INITIAL SITE INVESTIGATION REPORT
INSTALLATION RESTORATION PROGRAM**

**STEWART AIR NATIONAL GUARD BASE
NEWBURGH, NEW YORK**

MARCH 1988

VOLUME I - REPORT

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PHASE II/IVA

TASK 2A(1) - DRAFT
INITIAL SITE INVESTIGATION REPORT
INSTALLATION RESTORATION PROGRAM

VOLUME I

STEWART AIR NATIONAL GUARD BASE
NEWBURGH, NEW YORK

Prepared for:

HAZWRAP SUPPORT CONTRACTOR OFFICE
OAK RIDGE, TENNESSEE 37831

Operated by:

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FOR THE
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MARCH 1988

TASK 2A(1)
INITIAL SITE INVESTIGATION
STEWART AIR NATIONAL GUARD BASE

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EXECUTIVE SUMMARY

This document is the preliminary draft of the Initial Site Investigation Report, Task 2A(1) of the Phase II/IVA activities at the former landfill and adjacent pesticide burial site at the Stewart Air National Guard Base (ANGB) in Newburgh, New York. This site is an inactive landfill that was used by the U.S. Air Force (USAF), and is now leased to the New York Air National Guard (NYANG) by the New York State Department of Transportation. The landfill was operated by the USAF from approximately 1963 to 1970, and was used for the disposal of domestic refuse from base housing and waste from food-dispensing facilities and aircraft maintenance operations on-base. From 1970 to 1982, the landfill was operated by the New York Metropolitan Transit Authority and a contingent from the U.S. Military Academy (USMA). Disposal operations at the landfill were discontinued in 1982. An abandoned pesticide disposal trench is located approximately 150 feet west of the inactive landfill.

The Department of Defense initiated a four-phase Installation Restoration Program (IRP) at the Stewart ANGB to identify and evaluate suspected problems associated with past hazardous waste disposal and spill sites. As a subcontractor to the HAZWRAP Support Contractor Office, Oak Ridge, Tennessee, E.C. Jordan Co. (Jordan) of Portland, Maine, was assigned the task of acquiring site-specific data for the confirmation of contamination at the former landfill and the adjacent pesticide burial site at Stewart ANGB. The data will be part of the information used by Jordan to develop a Remedial Action Plan (RAP) and

to prepare designs and specifications for implementing site remediation, if required.

As a part of a study for the U.S. Environmental Protection Agency (USEPA), in January 1984, NUS Corporation (NUS) made an evaluation of groundwater, surface water, soil, and sediment samples in the general vicinity and downgradient of the Stewart Air Force Base Landfill and the New Windsor Landfill. Based on this limited study, NUS concluded that surface water, stream sediment, and soils in the vicinity of the former landfill and pesticide burial site at Stewart ANGB and the inactive New Windsor Landfill contain several volatile organic compounds (VOCs) and pesticides, and that these compounds could potentially have an impact on surface water downgradient of the landfills.

Between September 1983 and March 1986, Dames and Moore conducted a series of test pit and monitoring well installation explorations of the former landfill and pesticide burial areas. These studies emphasized the pesticide disposal trench. Test pit excavations confirmed the presence of buried containers with various concentrations of pesticides and acids. The monitoring well installations indicated pesticide contamination at a depth of 45 feet and a distance of 30 feet from the disposal trench.

Jordan prepared a Work Plan in response to a Statement of Work issued under the IRP for the Stewart ANGB site. It was reviewed by HAZWRAP, the Air National Guard Support Center, the Orange County Department of Health, and the New York State Department of Environmental Conservation (NYSDEC). Comments received on

the draft Work Plan were incorporated into a final Work Plan, which was approved before site field investigations began.

The investigation focused mainly on: (1) characterization of relevant geology and hydrogeology; (2) initial confirmation and quantification of contaminants; (3) identification of potential sources and receptors; and (4) determination of migration pathways. Subsurface explorations were conducted at 11 locations, with multiple piezometers installed in the test borings at each location. In addition, four monitoring wells were installed in separate borings at four of the exploration locations. One water sample and three soil/sediment samples were collected from surface locations. Eight soil samples were collected at depths ranging from 4 to 31 feet from eight of the subsurface explorations. Groundwater samples were collected once from each monitoring well. Samples (i.e., water and soil/sediment) were analyzed for inorganic compounds, VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), organophosphorus pesticides, chlorinated herbicides, chloride, fluoride, sulfate, and pH.

Information from the subsurface explorations indicated a fairly uniform glacial till deposit over a shale bedrock. These local geologic data conform to the published regional geologic conditions. Groundwater information from the monitoring wells and piezometers, and permeability testing conducted in selected installations, permitted the determination or calculation of hydrogeologic parameters and characteristics of the till and bedrock. The glacial till has a low to moderate permeability with an average hydraulic conductivity calculated at 4.19×10^{-5} cm/sec. The hydraulic gradient in the vicinity of the former

landfill and pesticide burial site is about 0.007 ft/ft, with an assumed effective porosity of about 0.2. The average groundwater velocity is approximately 1.52 ft/yr. In general, the site is in a recharge area above a shallow groundwater system located in the till. The bedrock aquifer beneath the glacial till is confined.

Vertical groundwater gradients between the bedrock and till are downward at most locations, ranging from 0.005 to 0.239. Groundwater flow in both the glacial till and bedrock is toward the east and southeast.

Results of chemical analysis of soil, sediment, groundwater, and surface water samples indicated that site contamination is apparently related to migration of the chlorinated pesticide residues 2,4'-DDT; 4,4'-DDT; 4,4'-DDD; and 4,4'-DDE from the disposal area. In the immediate vicinity of the pesticide pit, Dames and Moore detected pesticide concentrations at low mg/kg levels in the soil and at $\mu\text{g}/\ell$ levels in the groundwater (Dames and Moore, 1985 and 1986). Migration of pesticide residues was confirmed by Jordan in a ponded area approximately 450 feet northeast of the pit area, at concentrations of low mg/kg in the sediment and $\mu\text{g}/\ell$ in the surface water. VOCs were identified in the groundwater immediately downgradient of the landfill.

Based on the results of this study, collection of additional surface soil/sediment samples are recommended both downgradient and on the surface of the landfill, particularly downgradient of the pesticide disposal pit area. Multilevel monitoring wells are recommended in the downgradient area east of the landfill to further identify and quantify the potential plume suggested by

the low contaminant concentrations detected in existing downgradient monitoring wells. The existing wells are recommended for a second round of sampling.

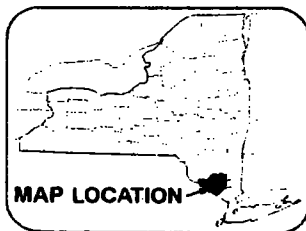
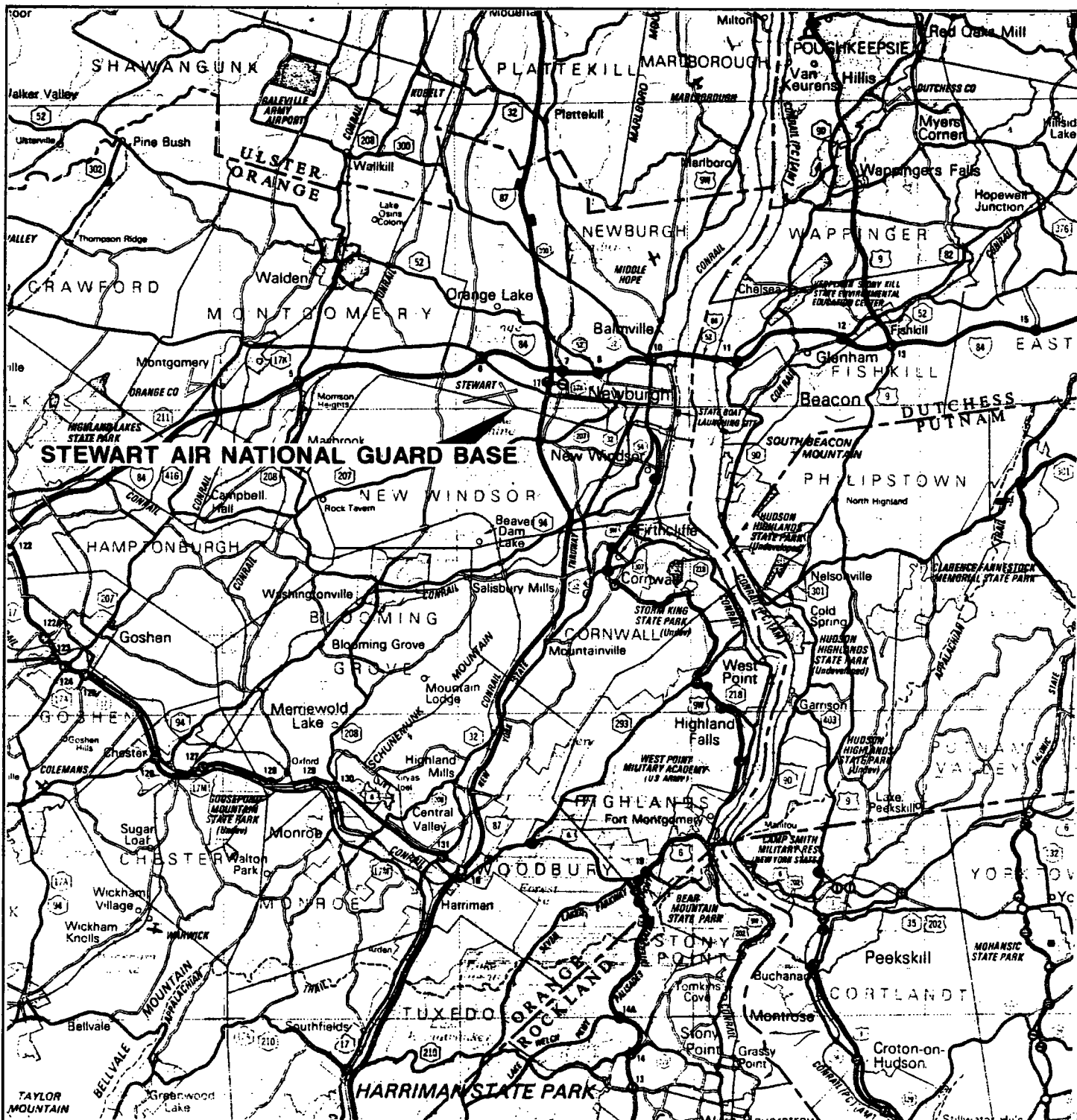
1.0 INTRODUCTION

The Department of Defense initiated a four-phase Installation Restoration Program (IRP) at the Stewart Air National Guard Base (ANGB) in Newburgh, New York (Figure 1-1) to identify and evaluate suspected problems associated with past hazardous waste disposal and burial sites. As a subcontractor to HAZWRAP, E.C. Jordan Co. (Jordan) of Portland, Maine, initiated the acquisition of site-specific data for the confirmation and quantification of environmental contamination at the former landfill and the adjacent pesticide burial site at Stewart ANGB (Figure 1-2). The data will be part of the information used by Jordan to develop a Remedial Action Plan (RAP) and to prepare designs and specifications for implementing site remediation, if required.

This report summarizes the results of Task 2A(1) of the Phase II/IVA activities (Initial Site Investigation). It includes a review of background information; a description of the investigation program, including soil, groundwater, and surface water sampling; a hydrogeologic evaluation; preliminary contamination and risk assessments; and conclusions and recommendations.

1.1 PURPOSE

The purpose of the Initial Site Investigation was to characterize the relevant geology and hydrogeology surrounding the former landfill and adjacent pesticide burial site; initiate confirmation and quantification of contaminants; identify



SOURCE: NEW YORK STATE
ATLAS, N.Y. STATE D.O.T.
1980, ORANGE COUNTY, P.36



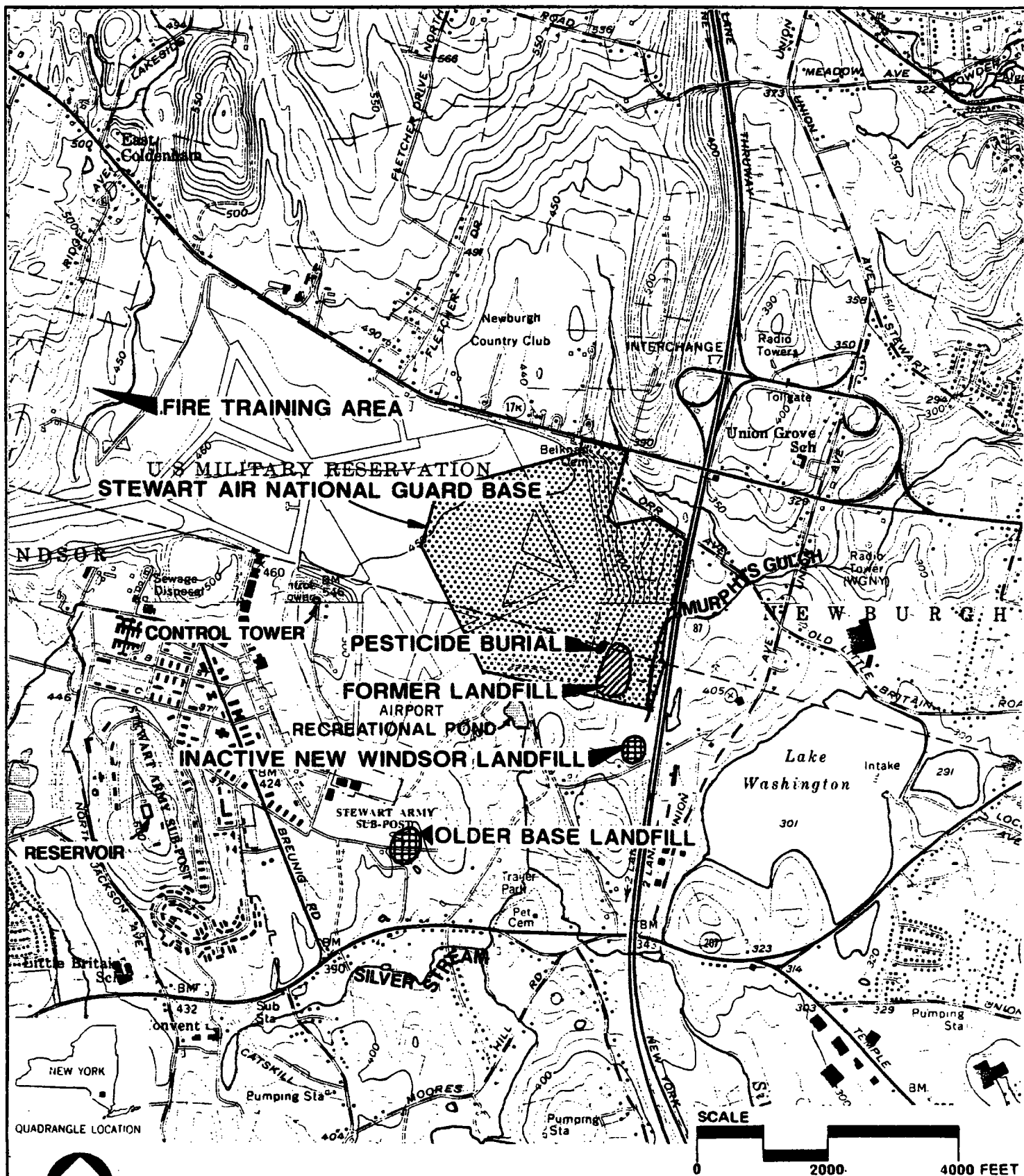
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REGIONAL LOCATION MAP

INSTALLATION RESTORATION PROGRAM
STEWART AIR NATIONAL GUARD BASE, N.Y.

TASK 2A(1)

FIGURE 1-1



SOURCE: U.S.G.S. NEWBURGH
AND CORNWALL, NEW YORK
QUADRANGLES (1957)
7.5 MINUTE SERIES

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INSTALLATION RESTORATION PROGRAM
STEWART AIR NATIONAL GUARD BASE, N.Y.

AREA LOCATION MAP

TASK 2A(1)

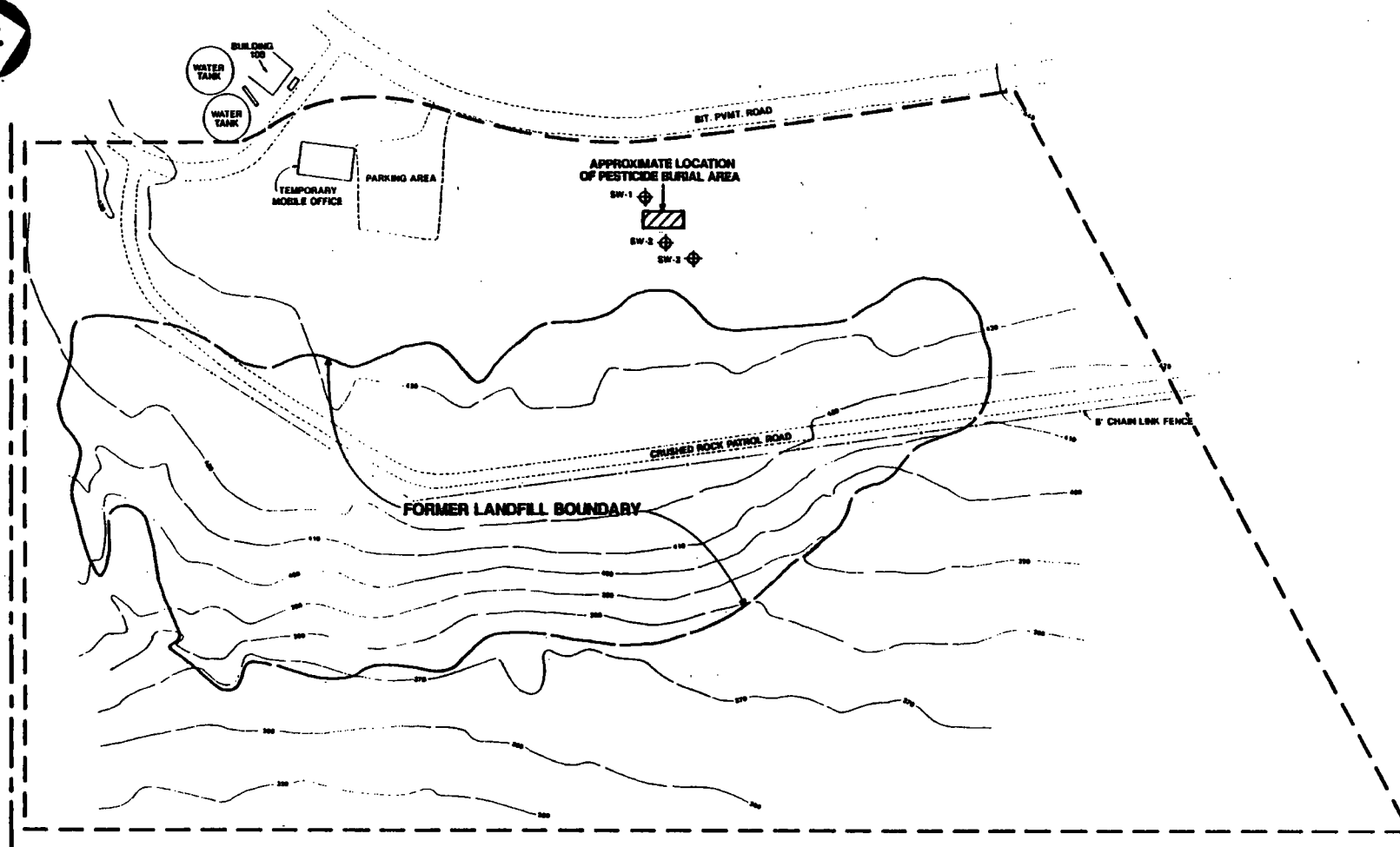
FIGURE 1-2

potential sources and receptors; and determine migration patterns and rates. The site and study area are shown in Figure 1-3. Based on the hydrogeologic characterization and preliminary determination of the distribution and degree of contamination, Jordan will develop a detailed task plan for the RAP-related Site Investigation (Task 2A(2)), to be submitted separately.







1.2 SCOPE

The scope of work required to fulfill Task 2A(1) objectives consists of nine subtasks, described in the Stewart ANGB Task 1 Work Plan, and summarized as follows:

- o Subtask 1 - Background Information Review
- o Subtask 2 - Site Clearing
- o Subtask 3 - Site Survey
- o Subtask 4 - Geophysical Surveys
- o Subtask 5 - Subsurface Exploration
- o Subtask 6 - Sampling and Analytical Program
- o Subtask 7 - Hydraulic Conductivity Determinations
- o Subtask 8 - Initial Site Characterization
- o Subtask 9 - RAP-related Site Investigation Plan



LEGEND

-  BOUNDARY OF FORMER LANDFILL
-  APPROXIMATE LOCATION OF PESTICIDE BURIAL SITE
LOCATION BASED ON VISUAL FIELD OBSERVATIONS AND AERIAL PHOTOGRAPHIC INTERPRETATION
-  PROPERTY LINE (APPROXIMATE)
-  APPROXIMATE STUDY AREA
-  EXISTING 8' CHAIN LINK SECURITY FENCE
-  APPROXIMATE LOCATION OF MONITORING WELLS INSTALLED BY DAMES AND MOORE



ECJORDANCO <small>CONVULS 100110 AND 1110</small>		SITE PLAN	
INSTALLATION RESTORATION PROGRAM STEWART AIR NATIONAL GUARD BASE, N.Y.		TASK 2A(1)	FIGURE 1-3

1.3 PRIOR STUDIES AND INVESTIGATIONS

As part of a study for the U.S. Environmental Protection Agency (USEPA), in January 1984, NUS Corporation (NUS) made an evaluation of groundwater, surface water, soil, and sediment samples in the general area downgradient of the Stewart Air Force Base Landfill and the New Windsor Landfill. Based on this limited investigation, NUS made the following general conclusions:

- o The city of Newburgh's drinking water and water supply (Washington Lake) are free of hazardous substance contamination.
- o Drinking water from private wells in the town of New Windsor in the vicinity of the former landfill and adjacent pesticide burial site and the New Windsor Landfill is free of hazardous substance contamination.
- o Surface water and sediments from Silver Stream, from its tributary origin at Stewart Airport to its diversion into the southern end of Washington Lake, are essentially free of hazardous substance contamination. Surface water, stream sediment, and soils in the vicinity of the former landfill and adjacent pesticide burial site the USMA Newburgh Landfill, and the New Windsor Landfill contain several volatile organic compounds (VOCs) and pesticides; these compounds may have an impact on Murphy's Gulch downstream of the landfills.

Between September 1983 and March 1986, Dames and Moore conducted a series of investigations at the former landfill and pesticide burial site. These studies

emphasized the pesticide disposal trench. Test pit excavations confirmed the presence of buried containers with various concentrations of DDT, parathion, heptachlor, 2,4-D (2,4-dichlorophenoxy acetic acid), 2,4,5-T (2,4,5-trichlorophenoxy acetic acid), hydrofluoric acid, hydrochloric acid, and sulfuric acid. Soil and groundwater samples obtained from the installation of three monitoring wells (see Figure 1-3) close to the pesticide pit (under the direction of Dames and Moore) indicate pesticide contamination to a depth of at least 45 feet and at a distance of 30 feet from the disposal area. Boring logs and schematic monitoring well installation diagrams from the 1986 Dames and Moore - Step 2 Report are presented in Appendix H. NYANG, under separate contract, is implementing actions for removal of the pesticides and acid containers and some contaminated soils in the immediate area of the pesticide burial pit.

2.0 PHYSICAL SETTING

The Stewart ANGB (part of the Stewart Airport Complex) is situated 2.5 miles west of the city of Newburgh, in the town of Newburgh, New York. The complex straddles the common border between the towns of Newburgh and New Windsor. The three municipalities are in Orange County, which is located on the western side of the Hudson River in the southwestern corner of New York State, approximately 35 miles northwest of New York City.

2.1 POPULATION CHARACTERISTICS

The city of Newburgh occupies approximately 4 square miles between the towns of Newburgh and New Windsor and the Hudson River. According to the 1980 Census, Orange County had a population of 260,000. The city of Newburgh, the town of Newburgh, and the town of New Windsor had populations of 23,400, 22,700, and 19,500, respectively.

2.2 LAND USE AND ZONING

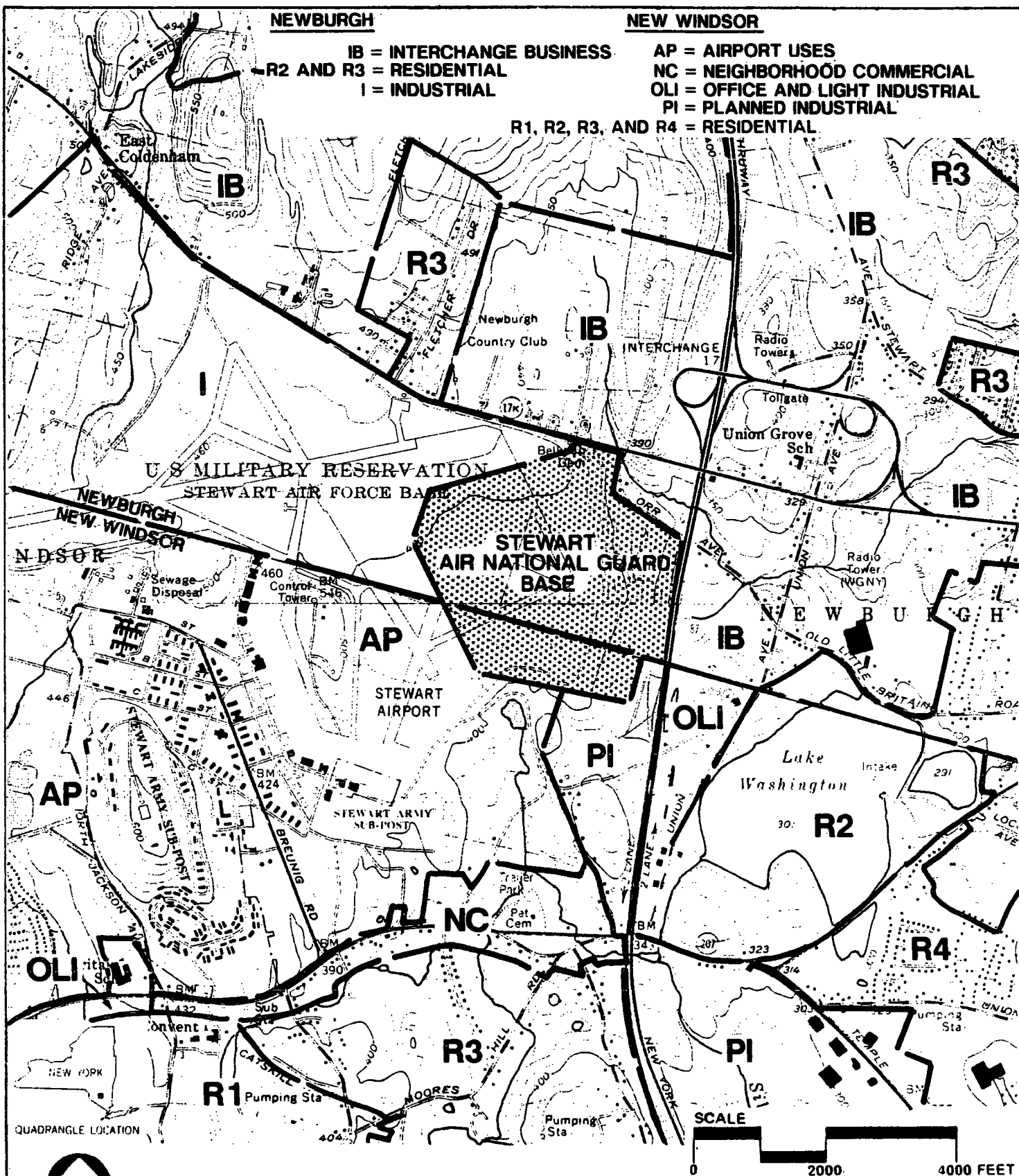
The airport property consists of landing strips, taxiways, and support areas for the Stewart Airport Complex and the New York Air National Guard (NYANG). These facilities are zoned for Industrial (I) (town of Newburgh) and Airport (AP) (New Windsor) uses. Portions of the surrounding zoning plans for both

towns are presented in Figure 2-1. In the town of Newburgh, the ANGB is bounded on the west and northwest by I zones, and on the north and east by Interchange Business (IB) zones. Some residential housing is scattered throughout the IB zone. In the town of New Windsor, the ANGB is bounded on south and southwest by AP zones, on the southeast by Planned Industrial (PI) zones, and to the east by Office and Light Industrial (OLI) zones. Residential housing is scattered throughout these zones.

2.3 NATURAL RESOURCES

The Newburgh area is located in an area of Chestnut, Chestnut Oak, and Poplar Forest types of the northeastern U.S. Prior to construction of the Stewart Airport, the complex area and land adjacent to the existing facility were heavily cleared for farming. Stonewalls, constructed during these activities, are still standing throughout the reforested, pasture, and cultivated areas. Orchards around the perimeter of the airport, clearly visible on 1963 and 1968 aerial photographs, have been nearly obliterated by perimeter activities (e.g., landfill development) and neglect. The former cleared areas immediately surrounding the former landfill on the Stewart ANGB property are in various stages of reforestation. East of the landfill, the regrowth consists in part of a nearly mature poplar stand with a high, well-developed canopy. North of this stand, the areas consist of a mixture of scrub growth and old pasture.

Surface drainage around the former landfill flows principally to the east (see Figure 1-2). This surface water flows northeast along the western side of the



SOURCE: U.S.G.S. NEWBURGH
AND CORNWALL, NEW YORK
QUADRANGLES (1957)
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ZONING MAP

TASK 2A(1)

FIGURE 2-1

New York State Thruway to a culvert, where it then turns eastward toward the Hudson River. This tributary to Quassaic Creek is known locally as Murphy's Gulch. The surface drainage flow in Murphy's Gulch west of the thruway, along the easternmost ANGB property line, has been partially restricted by vegetation and thruway embankment construction, causing ponding and increased growth of wetland vegetation. This surface water was formerly diverted to the city of Newburgh reservoir (Lake Washington). South of the former landfill, surface drainage is southward through the Recreational Pond to Silver Stream. In addition, surface water and stormwater runoff for part of the landing strips, taxiways, and support area is discharged in this same drainage area. Silver Stream is presently the major contributor to Lake Washington. ✓

2.4 CLIMATOLOGY

Winters in Orange County are cold; summers are moderately warm with occasional hot spells. The climate in the area is classified as humid continental. Total annual precipitation is 48 inches. The heaviest one-day rainfall during the period 1951 to 1974 was 4.76 inches at West Point on September 12, 1960. The sun shines 60 percent of the time in summer and 40 percent in winter. The prevailing wind is from the southwest. Climatological data at West Point, New York, are summarized in Table 2-1.

TABLE 2-1
TEMPERATURE AND PRECIPITATION DATA AT
WEST POINT, NEW YORK

TEMPERATURE (1)					PRECIPITATION (1)				
MONTH	AVERAGE DAILY MAXIMUM (°F)	AVERAGE DAILY MINIMUM (°F)	2 YEARS IN 10 WILL HAVE		AVERAGE (In.)	2 YEARS IN 10 WILL HAVE		AVERAGE NO. OF DAYS WITH 0.10 INCH OR MORE	AVERAGE SNOWFALL (In.)
			MAXIMUM TEMP. HIGHER THAN (°F)	MINIMUM TEMP. LOWER THAN (°F)		LESS THAN (In.)	MORE THAN (In.)		
JANUARY	35.2	19.2	58	-4	3.17	1.66	4.39	7	9.9
FEBRUARY	38.4	20.5	61	-4	3.44	2.33	4.45	6	11.4
MARCH	47.1	28.7	74	9	4.25	2.78	5.57	8	10.1
APRIL	61.2	39.2	87	24	4.25	2.78	5.58	8	1.4
MAY	71.9	48.9	93	34	3.94	2.20	5.34	8	.0
JUNE	81.5	58.5	98	45	3.92	2.10	5.41	7	.0
JULY	86.3	63.5	99	51	3.71	2.26	5.00	7	.0
AUGUST	84.2	61.9	96	49	4.16	1.94	5.96	6	.0
SEPTEMBER	76.2	55.4	95	37	4.10	2.34	5.53	6	.0
OCTOBER	65.0	44.9	84	27	4.04	1.66	5.96	5	.0
NOVEMBER	51.0	35.1	72	18	4.45	2.96	5.97	8	1.2
DECEMBER	38.6	24.4	61	4	4.49	2.57	6.04	7	8.5
YEAR	61.4	41.7	101	-6	48.01	41.18	54.56	83	42.5

(1) Recorded from 1951 to 1974 at West Point, New York

Source: Soil survey of Orange County, New York; U.S. Department of Agriculture, Soil Conservation Service, 1981.

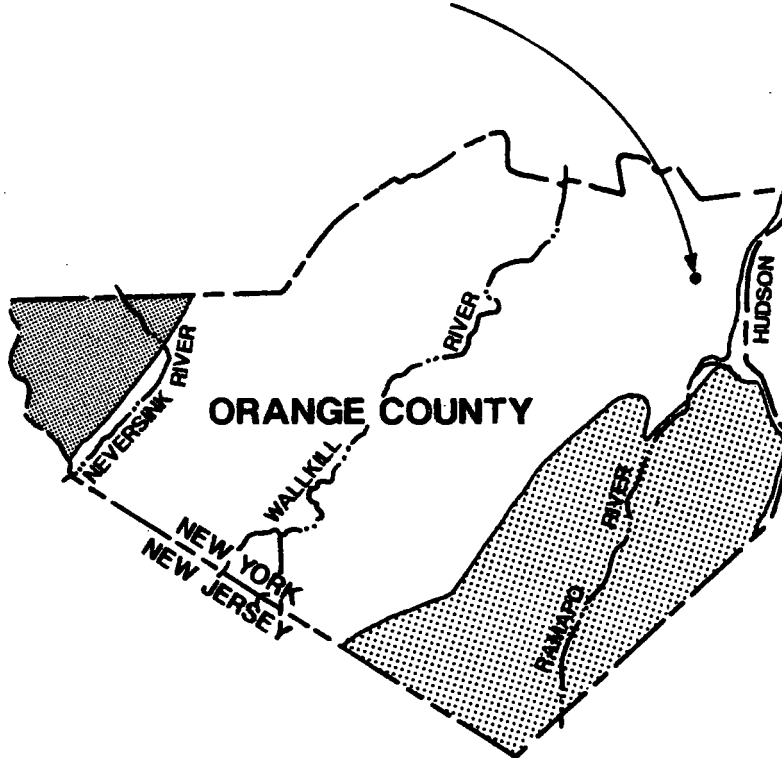
2.5 SITE PHYSIOGRAPHY AND DESCRIPTION

Orange County is 834 square miles in area. The county is part of the New England, the Valley and Ridge, and the Appalachian Plateau physiographic provinces (Figure 2-2) (Frimpter, 1972). Variations of bedrock lithology are responsible for the development of these distinct provinces. The southeastern portion of Orange County, known as the Hudson Highlands, lies in the New England Province. Altitudes range from near zero, at the Hudson River, to over 1,400 feet. The central part of Orange County, which includes the Newburgh area and Stewart ANGB, is within the Hudson-Champlain Lowland of the Valley and Ridge Province and is characterized by a low, rolling relief. Much of this land has been cleared for farms and orchards. The western corner of the county is within the Appalachian Plateau, and is a generally rugged, forested area.

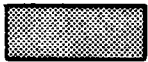
Immediately around the Stewart ANGB, the topography can be characterized as a gently to moderately rolling land surface. Hills and drainages are aligned in a regular north-south direction. Topographic relief ranges from an elevation of 301 feet at Lake Washington, to over 620 feet at the Army Sub Post reservoir, which is located approximately 4,000 feet southwest of the airport control tower (see Figure 1-2).

The former landfill is located on the eastern portion of the base complex (see Figure 1-2) along the upper side slope of a drumlin deposit, which is one of several topographic features modified during construction of the air base (USGS, 1901). Existing drumlins are evident in the surrounding area. The landfill topography is subtle and generally blends into the natural area at the

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LEGEND



APPALACHIAN PLATEAU PROVINCE



VALLEY AND RIDGE PROVINCE



NEW ENGLAND PROVINCE



PHYSIOGRAPHIC BOUNDARY



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**PHYSIOGRAPHIC PROVINCES
OF ORANGE COUNTY**

**INSTALLATION RESTORATION PROGRAM
STEWART AIR NATIONAL GUARD BASE, N.Y.**

TASK 2A(1)

FIGURE 2-2

upper elevations. The eastern slope of the landfill is over steepened. Household debris and demolition material are only partially covered and clearly visible at the base of the eastern slope. This area is covered by thick scrub brush and occasional scrubby trees.

The abandoned pesticide burial site is located west of and within approximately 100 feet of the former landfill. This site is at the same general surface elevation as the ANGB; no topographic expression identifies this area.

2.6 PAST SITE OPERATIONS

The former landfill was operated by the U.S. Air Force (USAF) from sometime after 1963 to 1970. It was reportedly used to dispose of domestic refuse from base housing and waste from food-dispensing facilities and aircraft maintenance operations on-base. From 1970 to 1982, the landfill was operated by the New York Metropolitan Transit Authority and a contingent from the U.S. Military Academy (USMA). Disposal operations at the landfill were discontinued in 1982. The land is now leased to the NYANG by the New York State Department of Transportation.

An abandoned pesticide disposal site is located approximately 100 feet west of the landfill (see Figure 1-3). Test pit excavations in April and May of 1984 confirmed the presence of buried containers in which various concentrations of DDT, parathion, heptachlor, 2,4-D, 2,4,5-T, hydrochloric acid, hydrofluoric acid, and sulfuric acid were found.

An inactive disposal area, formerly known as the New Windsor Landfill, is located approximately 500 to 1,000 feet southeast of the former landfill and pesticide burial site (see Figure 1-2). A portion of the New Windsor Landfill appears to have encroached onto the NYANG property. This disposal area was closed by order of the Town Board of New Windsor and the New York State Department of Environmental Conservation (NYSDEC). Bright orange leachate from this landfill can be observed flowing across the eastern edge of the Stewart ANGB property. This drainage eventually crosses under the thruway, continuing northeast to Brookside Pond which, in turn, drains into the Hudson River via Quassaic Creek.

3.0 BACKGROUND INFORMATION REVIEW

Jordan conducted a background search of available information to identify materials disposed of at the former landfill and pesticide burial site. This included available files at the base and interviews with current and former personnel familiar with site activities. In addition, personnel from the three water departments that supply water to residential and commercial users adjacent to the Stewart ANGB were interviewed. Aerial photographs, both current and historical, were examined to identify natural conditions and past landfill-related activities.

3.1 FILE SEARCH

A limited search was made for files associated with past military operations pertaining to disposal practices and the use of potential hazardous materials. Jordan was informed by Stewart ANGB personnel that USAF records were removed when the USAF left the facility. Jordan contacted the Air National Guard (ANG) Records Center in Washington, D.C., and was informed that, if records existed for Stewart, they were not on file at the center. In addition to the site background studies performed by others (see Section 1.3), Jordan reviewed some of the NYSDEC files pertaining to the former New Windsor Landfill.

3.2 PERSONNEL INTERVIEWS

Most information about the disposal of materials at this facility was obtained from independent verbal accounts provided by present and former base employees. The interview process was initiated by Jordan from a list provided by present ANG personnel, which was expanded upon. Table 3-1 lists the contacts made, title or activity, and affiliation. Table 3-2 is a matrix presenting contact information about former disposal activities at Stewart ANGB. Interview notes are presented in Appendix G.

In general, the most commonly received data identified more than one landfill on the base, and identified household trash and construction/demolition debris as the bulk of the material disposed. A Fire Training Area (FTA) was also identified as a potential source of hazardous materials. Only one landfill (i.e., the present site under investigation) was identified on the Stewart ANGB property. The FTA is located approximately 2,000 feet northwest of the former landfill, while the older base landfill is approximately 3,000 feet southwest (see Figure 1-2). Two contacts identified the potential disposal of solvents, while one contact made statements referring to pesticide containers and containers of paint, paint thinners, and oils disposed of at the landfills (see Table 3-1). The presence of drums with unknown contents were identified by three interviewees. However, it should be noted that some confusion may exist about which material went to the two landfills.

TABLE 3-1
PERSONNEL CONTACTS

<u>NAME</u>	<u>TITLE/ACTIVITIES</u>	<u>AFFILIATION</u> (Past & Present)
Wayne Buttles	Transit Maintenance	Air Force (1961-1970)
John Cinquamani	Fire Chief	Base Fire Department
Bill Fahr	Retired (present) Aircraft Maintenance	Air Force (1966-1970)
Chief Goldberg	Flight Engineer	Air Force (present)
Bill Hurd	Retired (present) Base Engineers Office	Air Force (1958-1970) NYMTA (1970-1983)
Lewis Murature	Vehicle Operator	NYMTA (1970-1983) Air Force (1951-1969)
Clayton Oestrich	Retired (present)	Air Force (1962-1970) Army (1970-1983)
Joseph Panoski	Flight Engineer	Air Force (1966-1969)
Jack Stamant	Airport Engineer NYS DOT	NYS DOT (present) Air Force (1967-1968)
Dick Wilson	Lockheed Terminal, Inc. Employee	Air Force, NYMTA, and Lockheed Terminal, Inc.
Mulhinder Saini	Environmental Officer	West Point (present)
Chuck Strobel	Post Engineer	U.S. Army (1973-present)

TABLE 3-2
PERSONNEL CONTACT INFORMATION - LANDFILL ACTIVITIES

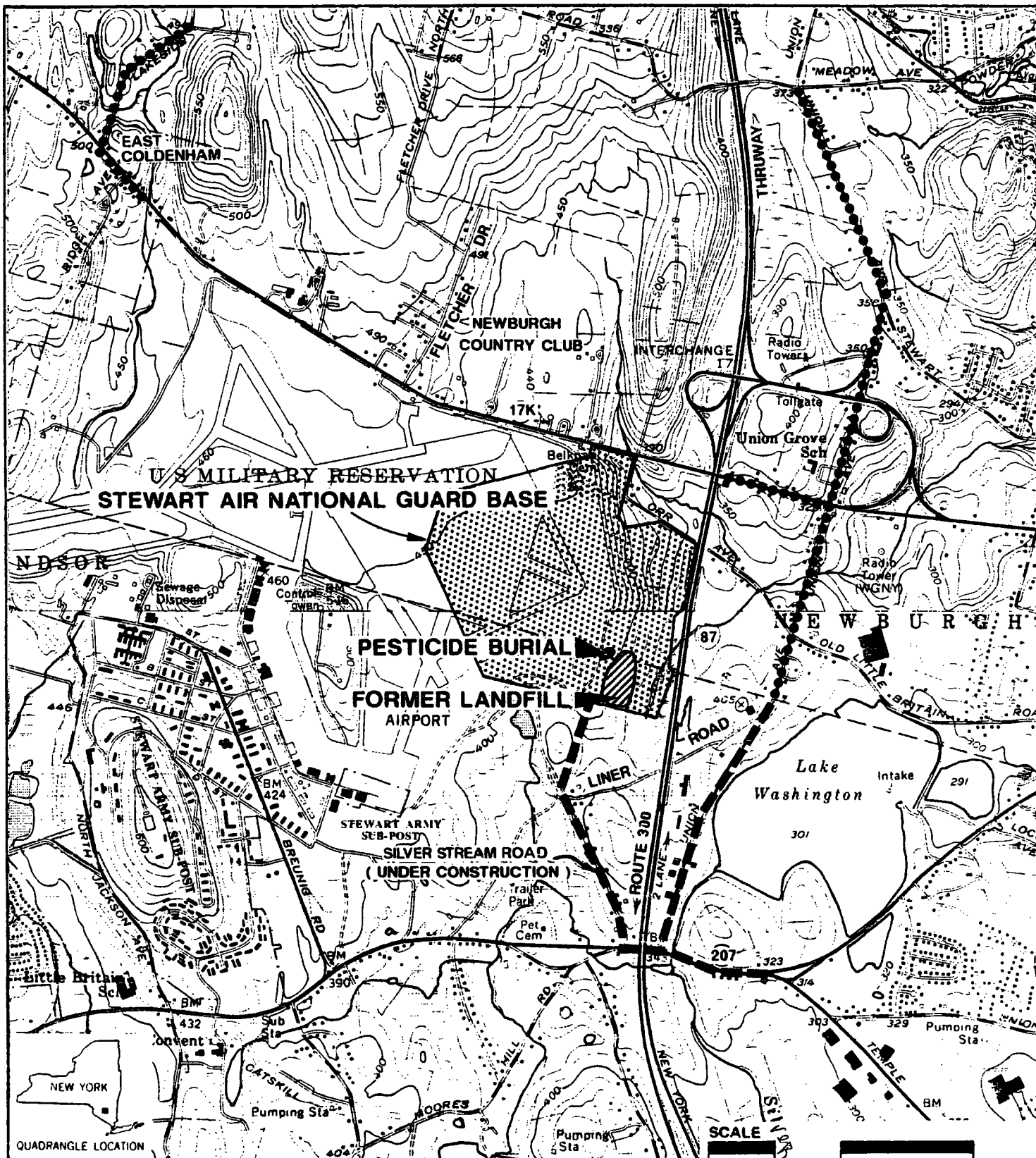
INDIVIDUAL	IDENTIFIED MORE THAN ONE SOURCE	IDENTIFIED HOUSEHOLD TRASH	IDENTIFIED CONSTRUCTION DEBRIS AND DEMO DEBRIS	IDENTIFIED PESTICIDES IN CONTAINERS	IDENTIFIED OTHER CONTAINERS (PAINT, PAINT THINNER, OILS)	IDENTIFIED ADDITIONAL CONTACTS	IDENTIFIED CLEANING SOLVENTS	IDENTIFIED DRUMS
Buttles	X	X	X	X	X			X
Cinquamani	X							
Fahr		X	X					
Goldberg						X		
Hurd		X						
Murature		X						
Oestrich	X	X	X					
Panoski							X	X
Stamant	X							
Wilson	X							
Strobel		X						

3.3 WATER SUPPLY AND DISTRIBUTION DATA

The three surrounding water departments were contacted to determine water supply sources and geographic distribution of the service areas adjacent to Stewart ANGB. Interviews were conducted with the following people:

- o Steve DiDio, Superintendent, Town of New Windsor Water Department
- o John Hess, Senior Operator, City of Newburgh Water Department
- o Frank Valdina, Superintendent, Town of Newburgh Water Department

The town of New Windsor water supply is the Catskill Aqueduct (i.e., the New York City water supply), with distribution along Union Avenue from Route 207 to the town line (Figure 3-1). No water is supplied to residential areas west of the thruway except for part of the Stewart Airport Complex, including the new line presently being completed to the NYANG facility. The city of Newburgh water supply is Lake Washington. The lake receives water from the surrounding watershed of Silver Stream upgradient from the diversion structure located near the corner of Route 203 and Union Avenue and Brown's Pond located in New Windsor. Murphy's Gulch (the drainage areas east and northeast of Stewart Airport Complex) formerly supplied water to Lake Washington by way of a diversion structure (i.e., Murphy's Gate) on Union Avenue. Murphy's Gate is presently closed due to potential contamination from the New Windsor Landfill and the former landfill at Stewart ANGB. The water resource from Brown's Pond is considered a back-up system to Lake Washington. The water from these sources is distributed to the city of Newburgh.



SOURCE: U.S.G.S. NEWBURGH
AND CORNWALL, NEW YORK
QUADRANGLES (1957)
7.5 MINUTE SERIES

LEGEND

- TOWN OF NEWBURGH
- ■ ■ ■ ■ TOWN OF NEW WINDSOR

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**SELECTED WATER
DISTRIBUTION ROUTES**

INSTALLATION RESTORATION PROGRAM
STEWART AIR NATIONAL GUARD BASE, N.Y.

TASK 2A(1)

FIGURE 3-1

The water supply for the town of Newburgh is currently Chadwick Lake (3 miles north of Stewart ANGB). The Water Department plans to obtain water from the Delaware Aqueduct. The Water Department supplies water south along Union Avenue to the town line, west on Route 17K to the thruway. West of the thruway, the town of Newburgh also supplies water south along Lakeside Road to East Coldenham. Additional distribution is planned for the Fletcher Drive and Newburgh Country Club areas.

Residential areas around the Stewart Airport Complex not serviced by public water include:

- o Route 17K, west of the thruway to East Coldenham
- o Orr Avenue, west of Union Avenue and east of the thruway
- o Liner Road, west of Union Avenue and east of the thruway
- o Silver Stream and Liner Roads, from Route 207 to the thruway

3.4 AERIAL PHOTOGRAPHY

Historical aerial photographs were reviewed at the Cornell Laboratory for Environmental Applications of Remote Sensing (CLEARS) library. Photographs of the base dated March 24, 1963; September 11, 1963; and March 27, 1968, were available at CLEARS. The 1963 photographs, at a scale of approximately 1 inch

equals 1,700 feet, clearly show no disposal activity at the former landfill located on the Stewart ANGB property. However, the photographs do show landfill activity at an older base landfill, located southwest of the present facility. These photographs also show the initial stages of disposal activities at the former New Windsor Landfill. The 1968 photographs, at a scale of approximately 1 inch equals 2,000 feet, show activity at all three landfill areas. At the Stewart ANGB Landfill (this study), the photographs clearly show a trench parallel to the southern property line, long piles of material running diagonally downslope toward the northeast, and a rectangular pit located adjacent to and west of the landfill. The location of the pit appears to coincide with the pesticide area identified in the Dames and Moore reports. The 1968 photographs show some activity continuing at the older base landfill and continued expansion of the New Windsor Landfill.

In addition, recent high altitude photographs taken in March 1984, as part of the National High Altitude Photography Program (NHAP), were reviewed. The photographs have an approximate scale of 1 inch equals 6,666 feet, and show no activity at either landfill; however, they do indicate that a portion of the New Windsor Landfill has encroached onto the southeasternmost corner of the Stewart ANGB property.

4.0 INITIAL SITE INVESTIGATION PROGRAM

Jordan developed the field investigation program to characterize the relevant geology and hydrogeology surrounding the former landfill and adjacent pesticide burial site, and to make a preliminary confirmation and quantification of the site contaminants in soils and groundwater at and downgradient of the site. This section describes the components of the Initial Site Investigation Program.

4.1 TECHNICAL APPORACH (WORK PLAN OVERVIEW)

In May 1987, Jordan completed the Phase II/IVA, Part A: Technical Program, Task 1 - Work Plan as part of the IRP for the Stewart ANGB in Newburgh, New York. The Work Plan described the items necessary to: (1) identify the extent of the former landfill and adjacent pesticide burial site; (2) characterize the geology and hydrogeology; (3) make a preliminary confirmation of potential contamination; and (4) prepare a site characterization report of the activities, findings, and recommendations of Task 2A(1). The subtasks to complete this investigation consisted of a background information review, site clearing for access purposes, a site survey, geophysical surveys, subsurface explorations, a sampling and analytical program, and report preparation. Based on the hydrogeologic characterization and determination of the distribution and degree of contamination, Jordan has developed a detailed Task Plan for the Task 2A(2)

- RAP-related Site Characterization as part of the activities of Task 2A(1), which will be submitted separately.

4.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or Relevant and Appropriate Requirements (ARARs) are federal and state public health and environmental requirements and guidelines that apply to hazardous waste site cleanup. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (or Superfund), the Superfund Amendments and Reauthorization Act (SARA), and the National Contingency Plan (NCP) require that all CERCLA-mandated hazardous waste site remedial actions comply with federal ARARs. SARA also requires attainment of state ARARs if they are more stringent than federal ARARs, are legally enforceable, and are consistently enforced statewide. ARARs are used to determine the appropriate extent of site cleanup, to scope and formulate remedial action alternatives, and to govern the implementation and operation of the selected action. Although the Stewart ANGB former landfill and pesticide burial site are not designated as Superfund sites and are not on the USEPA National Priority List (NPL), the identification of ARARs is useful to guide site investigation and evaluation work and future development of remedial action alternatives.

4.2.1 ARARs Definition

SARA defines ARARs as follows:

- o Applicable Requirements are federal and state requirements that would be legally applicable, either directly or as incorporated by a federally authorized state program. Applicable requirements have jurisdiction over other requirements in a given situation. An example of an applicable requirement is the use of Maximum Contaminant Levels (MCLs) for a site where groundwater contamination is actually entering a public water supply.
- o Relevant and Appropriate Requirements are federal and state requirements that, while not legally applicable, can be applied if, in the decision-maker's best professional judgement, site circumstances are similar to jurisdictionally covered situations and use of the requirement makes good sense. The term "relevant" is included so that requirements initially screened out as non-applicable because of jurisdictional restrictions can be reconsidered. For example, MCLs would be relevant and appropriate requirements for use at a site where groundwater contamination could effect a potential, as opposed to an actual, drinking water source, rather than an actual water supply. Relevant and appropriate requirements should be given the same weight for consideration as applicable requirements.
- o Other Requirements to be Considered are federal and state nonregulatory requirements, such as guidance documents or criteria. Non-promulgated

advisories or guidance documents do not have the status of potential ARARs. However, if there are no specific ARARs for a chemical or a situation, or if extant ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure public health and environmental protection.

4.2.2 ARARs Development

Under the description of ARARs set forth in the NCP and SARA, federal and state environmental requirements must be considered that are:

- o chemical-specific (i.e., govern the extent of site cleanup)
- o location-specific (i.e., pertain to existing site features)
- o action-specific (i.e., pertain to proposed site remedies and govern implementation of the selected site remedy)

Chemical-specific ARARs govern the extent of site cleanup and provide either actual clean-up levels or a basis for calculating such levels. For instance, groundwater and surface water criteria and standards would provide necessary clean-up goals for the Stewart ANGB site. Chemical-specific ARARs would also be used to indicate acceptable levels of discharge to determine treatment and disposal requirements, and to assess the effectiveness of future remedial alternatives.

Location-specific ARARs govern natural site features (e.g., wetlands), as well as manmade features including existing landfills, disposal areas, and local historic buildings. Location-specific ARARs generally restrict concentrations of hazardous substances or the conduct of activities solely because of the site's particular characteristics or location. These ARARs provide a basis for assessing existing site conditions and subsequently aid in assessing potential remedies. At the Stewart ANGB site, for example, location-specific ARARs that pertain to adjacent wetland areas would be considered.

Action-specific ARARs are usually technology- or activity-based limitations that control actions at hazardous waste sites. As remedial alternatives are developed, action-specific ARARs pertaining to proposed site remedies provide a basis for assessing feasibility and effectiveness. For example, action-specific ARARs could include hazardous waste transportation and handling requirements, air and water emissions standards, groundwater monitoring, the Resource Conservation and Recovery Act (RCRA) landfilling and treatment requirements, and worker safety requirements.

4.2.3 ARARs Identification

Based on Jordan's initial understanding of the Stewart ANGB former landfill and pesticide burial site, Table 4-1 identifies characteristics and chemical contaminants found in the soil, surface water, groundwater, and potential

TABLE 4-1

POTENTIAL CHEMICAL-SPECIFIC AND LOCATION-SPECIFIC ARARs
STEWART ANGB, NEW YORK

MEDIA	POTENTIAL FEDERAL ARARs	POTENTIAL STATE ARARs	OTHER REQUIREMENTS TO BE CONSIDERED
<u>Groundwater</u>	<ul style="list-style-type: none"> * RCRA Subpart F Groundwater Protection Standards, Alternate Concentration Limits (ACLs) ** Safe Drinking Water Act - Maximum Contaminant Levels (MCLs) (40 CFR 141.11-141.16) 	<ul style="list-style-type: none"> * 6 NYCRR Part 703 - NYSDEC Groundwater Quality Regulation ** Technical and Operations Guidance Series (TOGS) ** State Sanitary Code, Part 5 - Drinking Water Supplies ** Title 10 NYCRR Part 170 - Water Supplies ** NYSDOH PWS 69 - Organic Chemical Action Steps for Drinking Water ** NYSDOH PWS 159 - Responding to Organic Chemical Concerns at Public Water Systems 	<ul style="list-style-type: none"> Safe Drinking Water Act - Maximum Contaminant Level Goals (MCLGs) Clean Water Act - Ambient Water Quality Criteria Health Advisories (USEPA Office of Drinking Water) USEPA Risk Reference Doses (RfDs) USEPA Carcinogen Assessment Group Potency Factors Acceptable Intake - Chronic (AIC) and Subchronic (AIS) - USEPA Health Assessment Documents USEPA Office of Water Guidance - Water-related Fate of 129 Priority Pollutants (1979)
<u>Surface Water/Wetlands</u>	<ul style="list-style-type: none"> * NPDES Regulations (40 CFR 122, 125) 	<ul style="list-style-type: none"> * 6 NYCRR - Parts 701, 702, 704 - Surface Water Quality Standards * 6 NYCRR - Parts 750-757 - Implementation of NPDES Program in NYS ** Technical and Operations Guidance Series 	<ul style="list-style-type: none"> Federal Ambient Water Quality Criteria (AWQC)
<u>Soils/Sediment/Waste</u>	<ul style="list-style-type: none"> * Toxic Substance Control Act - PCB Disposal Requirements (40 CFR Part 761) ** Land Disposal Restrictions for Certain "California List" Hazardous Waste (40 CFR Part 260) 	<ul style="list-style-type: none"> * NYCRR - Part 371 Identification and Listing of Hazardous Waste (includes regulation of PCBs) 	
<u>Wetlands</u>	<ul style="list-style-type: none"> ** Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (40 CFR 230 Section 40 (b)) for Wetlands 	<ul style="list-style-type: none"> * NYCRR Parts 662-665 - Regulations for Freshwater Wetlands 	<ul style="list-style-type: none"> Wetlands Executive Order (EO 11990)

TABLE 4-1 (continued)

MEDIA	POTENTIAL FEDERAL ARARs	POTENTIAL STATE ARARs	OTHER REQUIREMENTS TO BE CONSIDERED
	* Clean Water Act (CWA) - 40 CFR Part 404	* ECL Article 24 and Article 71, Title 23 - Freshwater Wetlands Act	
	** Fish and Wildlife Coordinations Act (16 U.S.C. 661)		
	* National Environmental Policy Act - 40 CFR Part 6		

* Applicable

** Relevant and Appropriate

chemical- and location-specific ARARs. Because of the potential for future and known drinking water sources, these ARARs will influence the hydrogeological sampling and analysis program in the site investigation by requiring consideration of drinking water standards contamination levels. The presence of wetlands in the landfill vicinity will also influence well placement to determine the presence or absence of contaminants in water potentially flowing from the landfill to the wetlands. These ARARs will continue to be reviewed and updated as site data are confirmed and quantified. Action-specific ARARs will be considered and developed as part of the RAP.

4.3 SURVEY AND BASE MAP PREPARATION

In accordance with Subtask 3, Jordan prepared a survey base map of the site and immediately adjacent areas for horizontal and vertical control. The vertical and horizontal components were surveyed to within ± 0.1 and ± 1.0 feet, respectively. The survey included key features of the site and exploration locations. A base map for the site is presented in Volume II of this report as Plate 1.

5.0 GEOPHYSICAL INVESTIGATION

Jordan conducted a geophysical survey at the Stewart ANGB from July 14 to 16, 1987. The purpose of the survey was to define the limits of the base landfill and to delineate the presence, if any, of a conductive groundwater plume emanating and flowing in a direction hydraulically downgradient from the landfill. The landfill boundaries were mapped with a magnetometer, and conductive groundwater was delineated with a terrain conductivity meter. For this study, an EDA Instruments Omni Plus magnetometer with vertical gradiometer capability was used. A Geonics EM-31 Terrain Conductivity Meter was used for the plume-tracing activities.

5.1 MAGNETOMETER SURVEY

The magnetometer survey consisted of a series of traverses oriented in a direction approximately perpendicular to the presumed landfill boundary. Magnetometer measurements were referenced to a baseline laid out by the field party. Jordan personnel located the baseline by using a compass and cloth tape, referencing the baseline to known landmarks wherever possible. Measurements along individual traverses were 10 feet apart, and traverses were generally separated by 50 to 100 feet around the landfill perimeter. In the northeastern portion of the landfill, Jordan concluded that the boundary was adequately defined by topographic expression.

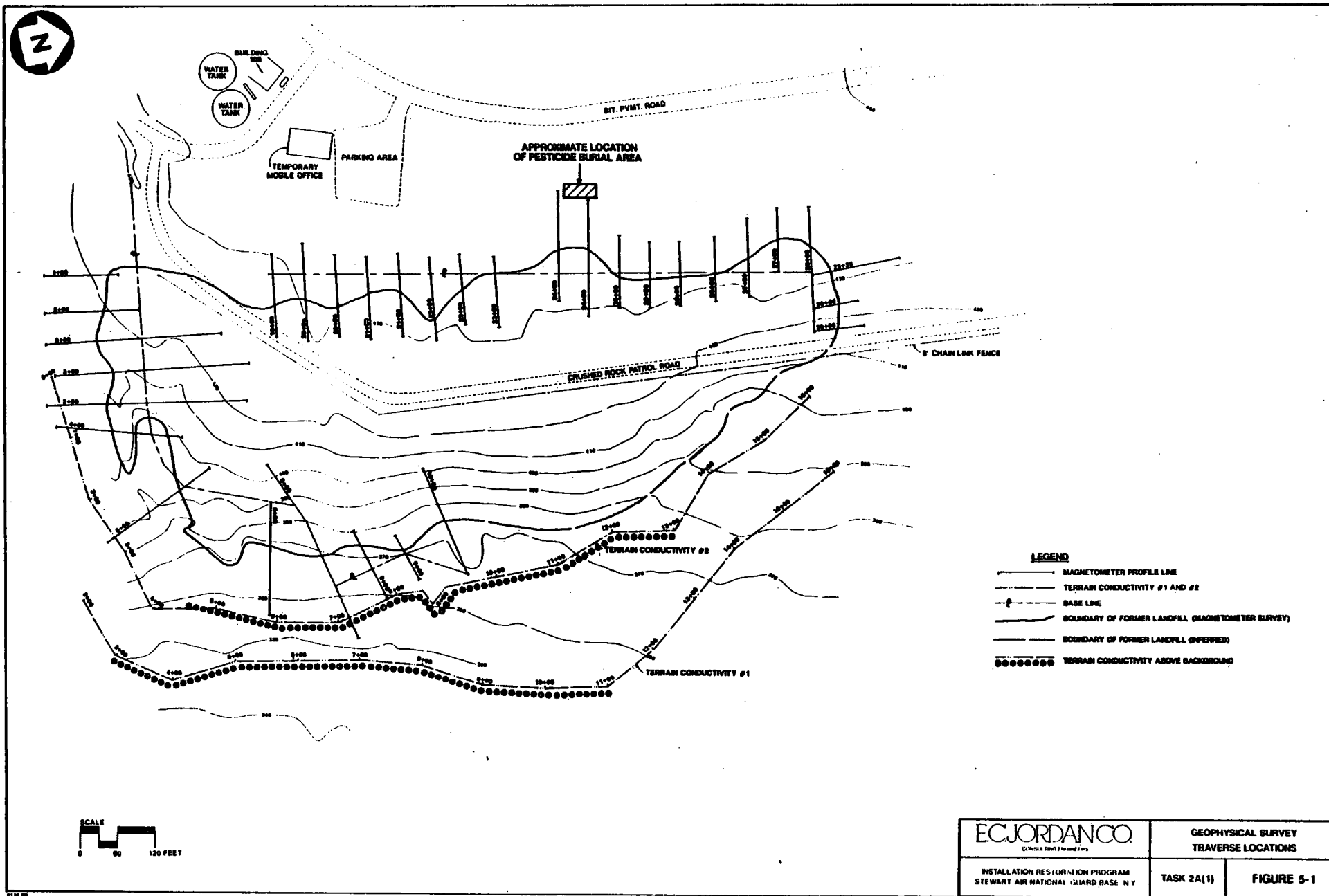
The magnetometer data were very sensitive to the presence of landfill refuse, because it generally contains enough ferrous material to create a significant magnetic disturbance. The interpreted position of the landfill perimeter and magnetometer survey traverses are shown in Figure 5-1. Appendix A explains the magnetic technique and presents the raw data used to interpret the landfill boundaries (see Figures A-2 through A-20).

5.2 TERRAIN CONDUCTIVITY SURVEY

The terrain conductivity survey consisted of two subparallel traverses. Line 1 is situated approximately 100 feet from the eastern toe of the landfill (hydraulically downgradient). Line 2 is approximately 200 feet away from the toe of the landfill. Measurements were taken at 20-foot intervals along each traverse. The approximate locations of the terrain conductivity survey traverses are shown in Figure 5-1.

The terrain conductivity data are presented in profile form in Appendix A (see Figure A-21). The data units are expressed in millimhos per meter. Background values range from 3 to 5 millimhos per meter. Conductive subsurface conditions are indicated by values above background levels on Line 1 (Stations 500 to 1300) and Line 2 (Stations 300 to 1100).

The location of monitoring well JMW-108 was selected to coincide with the higher surface conductive condition observed between Stations 500 and 1300 on Line 1. There is no apparent correlation between the measured terrain



conductivity values and specific conductivity values measured in the monitoring wells during sampling episodes. Jordan therefore concludes that the terrain conductivity values reflect the conductivity of the surface soils, which reflect the constituents of intermittent surface water flowing away from the landfill, rather than deeper groundwater conditions.

6.0 SOILS

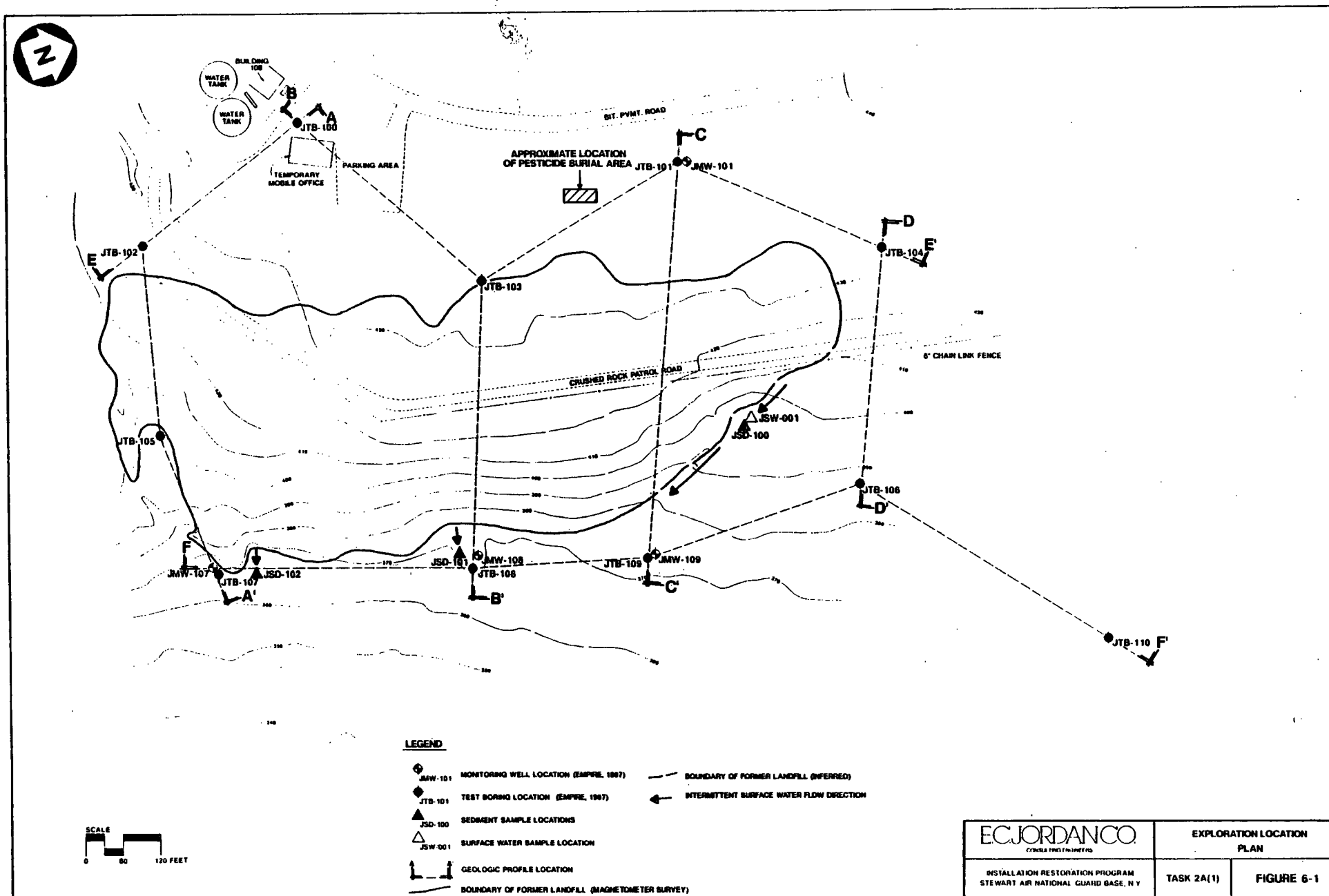
The interpretation of geologic conditions at the site is based on surface and subsurface explorations and existing geologic and previous site reports in the vicinity of the former landfill and pesticide burial site. The exploration program, surficial soils, geology, and sampling and analytical results are discussed in this section.

6.1 HAND SAMPLES AND BORINGS

Soil samples were collected by hand and from soil borings at the site to characterize geologic materials and to obtain samples for laboratory analysis. The following subsections describe these investigations. Figure 6-1 shows the hand sediment and test boring locations.

6.1.1 Hand Samples

Surface soil and sediment samples collected at three locations downgradient from the landfill area are designated JSD-100 through JSD-102. The samples, consisting of the 1- to 2-inch layer of sediment and soil, were collected with stainless steel laboratory spatulas. The spatulas were cleaned and sealed in plastic Ziploc bags in the laboratory, prior to their use in the field investigation.



The JSD-100 soil/sediment samples were collected from a manmade water-filled swale at the northeastern corner of the landfill (see Figure 6-1). This soil/sediment consisted primarily of a soft, gray and brown, colloidal silt-like material in approximately 4 to 6 inches of water. Because of the availability of what appeared to be a homogeneous material, this sample site was used to collect the duplicate, replicate, matrix spike, and matrix duplicate spike samples. Sample locations JSD-101 and JSD-102 (see Figure 6-1) were selected based on visual indications of intermittent seepage flow immediately downgradient from the toe of the landfill. No surface water was present at these locations when the samples were collected. At both locations, the loose forest litter was removed prior to sample collection. Both samples consisted of an olive-brown clayey silt with a trace of fine gravel and organics.

6.1.2 Borings

Eleven test borings (JTB-100 through JTB-110) were completed at the Stewart ANGB site using either 4.25-inch ID, hollow-stem augers or 4-inch ID, flush-jointed spun casings in soil and weathered rock (see Figure 6-1). Borings were completed to bedrock using an NX-size core barrel or roller bit. In general, split-spoon soil samples were collected at 5-foot intervals to characterize the geology and subsurface contamination at the sites. Split-spoon samples were scanned with a photoionization (PI) meter during sample collection activities to determine whether VOCs were present. Soil samples were logged according to geologic characteristics, soil classification, and other observations (see Appendix B). Four split-spoon samples were selected from the 11 test borings for chemical analysis. Drilling data for the test borings and installation of

monitoring wells and piezometers are summarized in Appendix B-3. Split spoons were decontaminated between each sample to prevent cross-contamination, according to procedures in the Quality Assurance Project Plan (QAPP).

6.2 SOILS

The general soil unit in the Stewart ANGB area is the Mardin-Erie (USDA-SCS, 1981). This unit, formed on upland glacial till deposits, consists of gently sloping and sloping, deep, moderately well-drained and somewhat poorly drained, medium textured soils. Extensive modification of the soil and topography has occurred in the developed areas at the Stewart ANGB facility. The airfield and runways were constructed primarily by cut and fill of the existing on-site materials. These glacial till materials, originally deposited as drumloidal hills with crest elevations of slightly over 500 feet, were cut to an approximate 450-foot elevation.

The soils at lower elevations, such as the eastern side of the Stewart ANGB property along the thruway, consist of Alden silt loam, a poorly drained glacial till soil capped or mixed with local colluvial material.

6.3 GEOLOGY

The interpretation of the regional and local geologic conditions at the site is based on subsurface investigations, reconnaissance of the area, and published geologic literature.

6.3.1 Regional Geology

The regional geology in the area around Newburgh is relatively simple. A large portion of the Hudson-Champlain Valley is underlain by alternating layers of slaty and soft shales. These shales, originally identified by Holywasser (1926) as the Hudson River Formation, comprise the youngest unit in the area. The Hudson River Formation is presently known and mapped as the Normanskill Formation (Figure 6-2) (Fisher, 1970). Isoclinal folding is evident throughout much of the formation, with the long axis trending slightly east of north. The folds are overturned toward the west. Within rocks of this group, a slaty cleavage is evident at about 30 degrees to the bedding planes. Most beds dip steeply to the east (Holywasser, 1926).

Cronomer Hill, northwest of the city of Newburgh, and Snake Hill, southwest of the city, consist of Pre-Cambrian gneiss and schist. Holywasser describes this as a klippe; that is, an erosional remnant of Pre-Cambrian rocks from the Hudson Highlands (Holywasser, 1926). A very narrow conglomeratic quartzite lies conformably over the schist and is, in turn, conformably overlain by a gray limestone known as the Wappinger Limestone. A combination of thrust and gravity faults separate these lithological units.



LEGEND

- ▲ NORMANSKILL FORMATION (FOLDED SHALE & SANDSTONE)
- WAPPINGER FORMATION (DOLOMITE LIMESTONE)
- CRYSTALLINE ROCKS (SCHISTS & GNEISSES)
- CONTACT
- FAULT (DASHED WHERE INFERRED)

BASE MAP FROM U.S.G.S. TOPOGRAPHIC 7.5-MINUTE SERIES
 NEWBURGH, N.Y., 1957. CORNWALL, N.Y., 1957; AND
 FISHER, et. al., 1970.

0 4000 8000 FEET

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GEOLOGY OF THE
 NEWBURGH, N.Y. AREA

INSTALLATION RESTORATION PROGRAM
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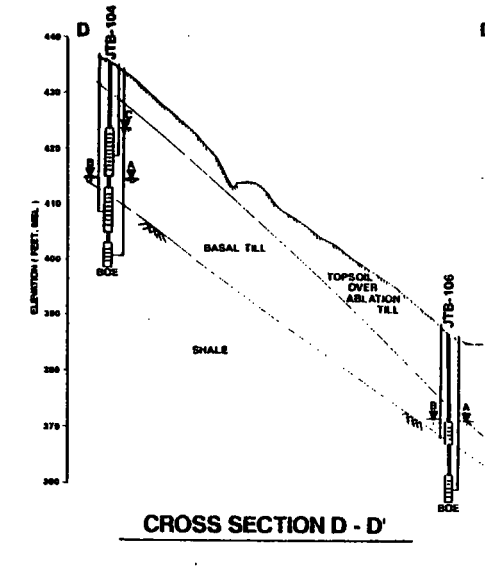
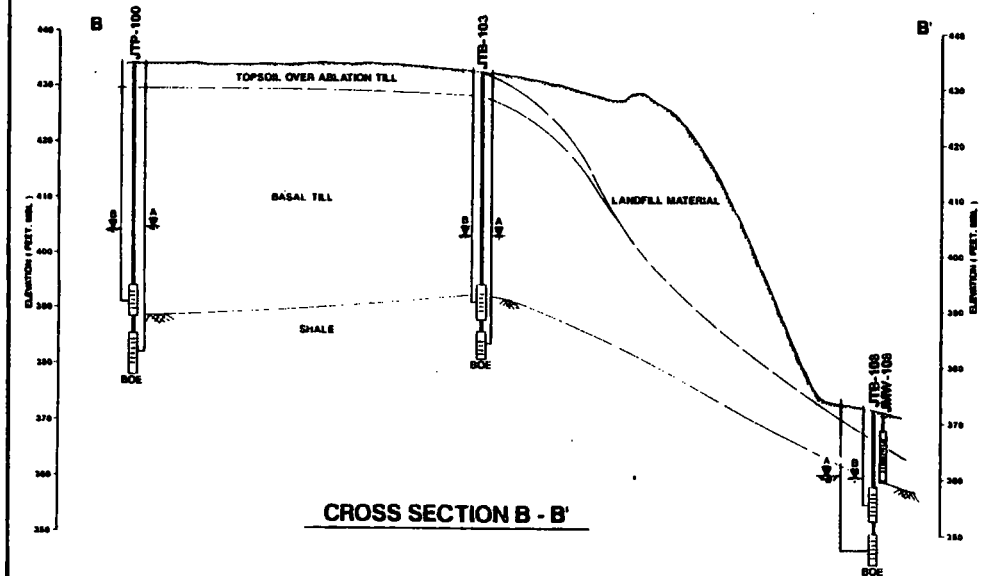
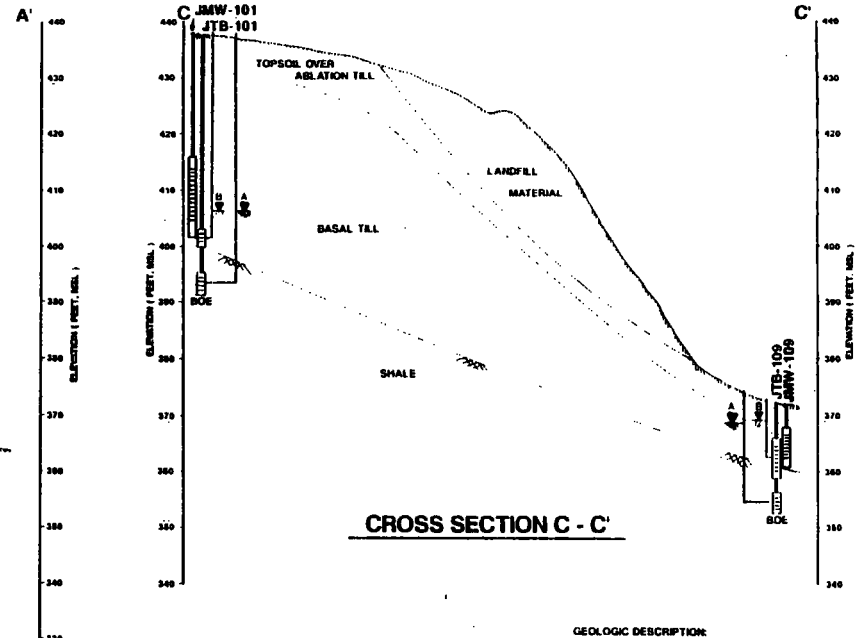
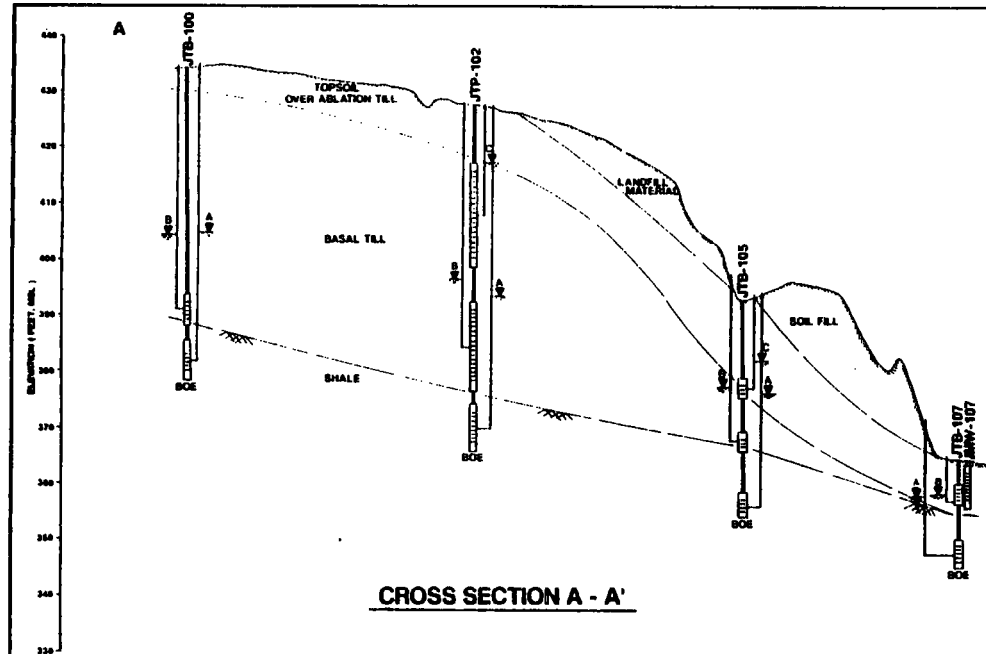
TASK 2A(1)

FIGURE 6-2

Pleistocene (glacial) deposits consisting primarily of gravel and sand, boulders, clays, and lacustrine material overlie the bedrock. These materials are extremely varied in thickness and texture.

6.3.2 Local Geology

The bedrock underlying the site is part of the Normanskill Formation. These rocks consist of thinly laminated, gray to blackish gray shale with calcite lenses and veins. The rocks appear to be highly fractured in the upper portions (zero to 10 feet deep). The deeper shale formation appears to be very competent, based on low water yields encountered in a deep groundwater production well recently drilled to support the Stewart ANGB construction. In general, the bedding was observed to have a dip angle of approximately 45 degrees from vertical. One rock core (JTB-110) exhibited bedding dips of approximately 70 degrees from vertical. Most of the observed fractures and core breaks were parallel and subparallel to the bedding surfaces. Weathering is slight to moderate along natural fracture faces. Minor inclusions of calcite were observed in JMW-106 and JMW-101. The transition from soil to competent unweathered bedrock is gradual, ranging from approximately 5 to 10 feet thick. The soil stratum and competent bedrock surface are depicted on the subsurface profiles (Figures 6-3 and 6-4). The depth of landfill material shown on the Interpretive Geologic Profiles is inferred from the general topography and the excavation identified on aerial photographs (see Section 3.4). In general, the bedrock surface slopes southeast and east from a bedrock high at JTB-104.



GEOLOGIC DESCRIPTION

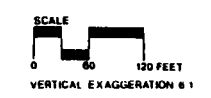
- ABLATION TILL** - THIS STRATUM CONSISTS OF TOPSOIL OVER GENERALLY LOOSE BROWN GRAVELLY SAND WITH SOME SALT AND TRACE OF CLAY
- BASAL TILL** - THIS STRATUM CONSISTS OF GENERALLY DENSE GRAY SANDY SALT WITH SOME CLAY AND GRAVEL
- SHALE** - NORMANSKILL FORMATION CONSISTS OF GRAY TO BLACKISH GRAY SHALE WITH CALSITE LENSES AND VENS

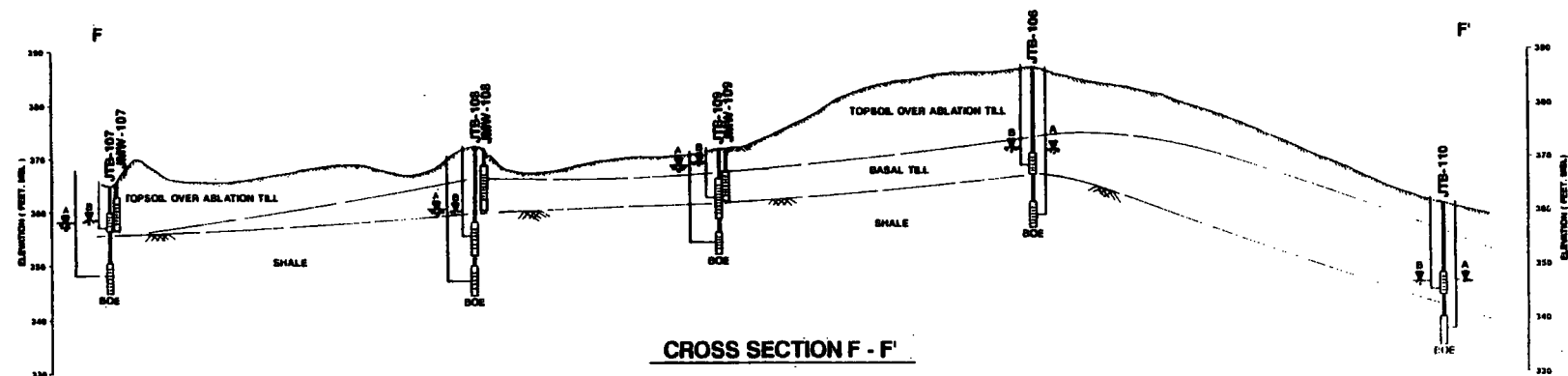
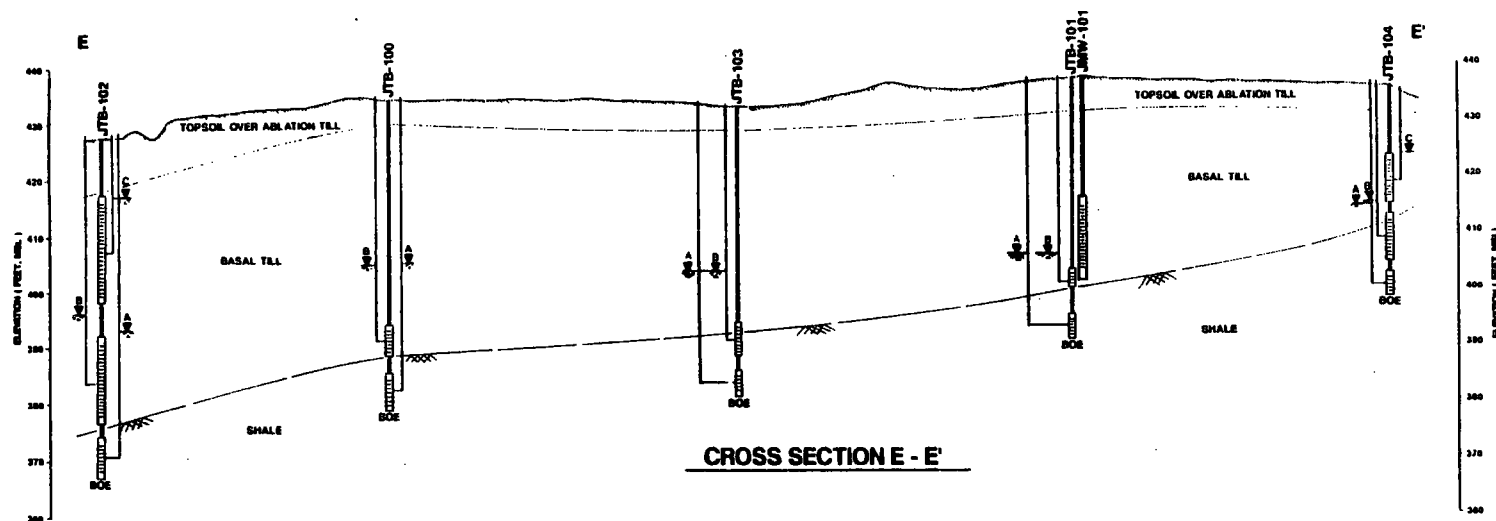
NOTES:

1. SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.

LEGEND

- PIEZOMETER LOCATION**
- PIEZONE IS A DEPTH DESIGNATOR**
- OBSERVED WATER LEVEL (FEET, MSL)**
- SEPTEMBER 18, 1987**
- EFFECTIVE 1981 FROM TOTAL SAME 1981/1982**
- BOTTOM OF EXPLORATION**
- INTERPRETED BEDROCK SURFACE**





GEOLOGIC DESCRIPTION:

- ABLATION TILL - THIS STRATUM CONSISTS OF TOPSOIL OVER GENERALLY LOOSE BROWN GRAVELLY SAND WITH SOME SALT AND TRACE OF CLAY.
- BASAL TILL - THIS STRATUM CONSISTS OF GENERALLY DENSE GRAY SANDY SALT WITH SOME CLAY AND GRAVEL.
- SHALE - NORMANSKILL FORMATION CONSISTS OF GRAY TO BLACKISH GRAY SHALE WITH CALCITE LENSES AND VENS.

NOTES:

- 1 SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE.
- 2 PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.

LEGEND



PEREZOMETER LOCATION

PEREZOMETER DEPTH DESIGNATION
OBSERVED WATER LEVEL (FEET, MSL)
SEPTEMBER 14, 1987

EFFECTIVE INTERVAL TOTAL SAND LENGTH
BOTTOM OF EXPLORATION

INTERPRETED BEDROCK SURFACE

SCALE
0 50 100 FEET
VERTICAL EXAGGERATION 5:1

ECJORDANCO
CONSULTING ENGINEERS

INSTALLATION RESTORATION PROGRAM
STEWART AIR NATIONAL GUARD BASE, N.Y.

INTERPRETIVE
GEOLOGIC
PROFILES E-E' AND F-F'

TASK 2A(1)

FIGURE 6-4

The surficial material overlying bedrock consists primarily of poorly sorted and well-graded glacial tills. In general, a brown weathered till overlies a deeper unweathered gray till. Finer stratified sand and silt materials were encountered at the surface on the lower elevations, downslope from the landfill. The materials appear to represent either a slope wash deposit or a thin stratum of lacustrine material. Because this deposit is relatively thin and discontinuous, it is not shown as a separate stratigraphic unit on the subsurface profiles or boring logs.

Results from 12 grain-size analyses performed on the till indicate a well-graded material with a fine fraction (i.e., percent by dry weight passing the U.S. No. 200 sieve), of between 25 and 46 percent and 43 and 55 percent for the brown weathered till and the gray unweathered till, respectively. Both the stratified sand and silt stratum and the highly weathered portion of the bedrock exhibited a slight bimodal grain-size distribution. Grain-size distribution curves are presented in Appendix C.

6.4 SOIL SAMPLING

As part of the initial site investigation, 11 soil samples were collected from separate locations for chemical analyses. Three samples (i.e., JSD1000101, JSD1010101, and JSD1020101) were taken from the surface soil from selected locations downslope of the landfill. Four subsurface soils samples (i.e., JMW1013101, JMW1070401, JMW1080701, and JMW1090501) were collected from each of the four monitoring well borings from a depth within the effective screened

interval. Sample JMW1070401 was also selected because the adjacent exploration sample (i.e., JTB1070401) presented the only PI meter reading above background observed during the investigation. The other four analytical samples (i.e., JTB1021201, JTB1030501, JTB1050701, and JTB1060501) were selected to evaluate aerial distribution of contaminants and to sample a range of stratigraphic characteristics. Analytical results are discussed in the following section and summarized in Table 6-1.

6.5 RESULTS OF SOIL/SEDIMENT ANALYSES

Each surface and subsurface soil sample was analyzed for the metals, VOCs, semivolatile organic compounds (SVOCs), organophosphate and chlorinated pesticides, herbicides, and polychlorinated biphenyls (PCBs) contained on the USEPA Hazardous Substance List (HSL). In addition, samples were analyzed for the chloride, fluoride, and sulfate anions, and measured for soil pH. Analyses were performed for the CERCLA-SARA USEPA National Contract Laboratory Program (CLP), Caucus Organics Protocol (CLP-COP) or Caucus Inorganics Protocol (CLP-CIP), as appropriate. VOCs and SVOCs were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), except for organophosphate and chlorinated pesticides, herbicides, and PCBs, which were analyzed by GC only. Metals were analyzed by atomic absorption and plasma emission spectrometry, and anions were characterized by wet chemical methods.

The complete data base, as presented in Appendix E, includes positive results, data qualification flags, sample identification number explanation, and results

TABLE 6-1
Summary of Soil Chemical Analysis
Stewart Air National Guard Base

ECJ SAMPLE ID		JMW1013101	JMW1070401	JMW1080701	JMW1090501
COMPUCHEM ID		145827	144191	144768	145249
DATE SAMPLED		08/10/87	08/01/87	08/04/87	08/06/87
DEPTH (ft)		31	4	7	5
MATRIX		SOIL	SOIL	SOIL	SOIL
INORGANIC COMPOUNDS (mg/kg)	DETECTION LIMIT				
ARSENIC	2	3.4 N	-	2.3 N	-
CADMIUM	1	-	-	-	-
CHROMIUM	2	11	11	11	12
COPPER	5	25 E	6.7	20	24 E
LEAD	1	9.5 N	9.6 N	8 N	20
MERCURY	0.02	-	-	0.13 N	0.11 N
NICKEL	8	13	11	12	17
ZINC	4	117	54	-	-
BARIUM	40	52	-	-	-
IRON	20	18800	17700	17800	21400
MANGANESE	3	790	594	504	999
VANADIUM	10	12	-	-	14
ALUMINUM	40	8140	7810	7510	9220
MAGNESIUM	100	5830 E	3370 E	3250	3820 E
CALCIUM	100	30900	1800	2120	2490
POTASSIUM	100	-	883	-	-
PCBs (ug/kg)					
AROCOR-1254	160	210	-	-	-
pH, SULFATE, CHLORIDE, FLUORIDE (mg/kg)					
PH		9.3	7.5	8	7.2
SULFATE		1100	-	-	-
FLUORIDE		-	0.44	3.5	1.8
CHLORIDE		39	-	25	-
PERCENT SOLIDS		87	87	90	88

E - INDICATES A VALUE ESTIMATED DUE TO THE PRESENCE OF INTERFERENCE.
N - INDICATES SPIKE SAMPLE RECOVERY IS NOT WITHIN CONTROL LIMITS.
- - ANALYZED FOR BUT NOT DETECTED

TABLE 6-1 con't.
Summary of Soil Chemical Analysis
Stewart Air National Guard Base

ECJ SAMPLE ID		JDUP01XX01	JSD1000101	JSD100MSD	JSD100MSD1
COMPUCHEM ID		144007	144003	144009	144017
DATE SAMPLED		07/30/87	07/30/87	07/30/87	07/30/87
DEPTH (ft)		0	1	0	0
MATRIX		SOIL	SOIL	SOIL	SOIL
INORGANIC COMPOUNDS (mg/kg)	DETECTION LIMIT				
ARSENIC	2	3.4 N	3.9 N	4.4 S N	4.3 N
CADMIUM	1	3.6	-	3.7	-
CHROMIUM	2	16	21	15	18
COPPER	10	-	44	-	40
LEAD	1	22 N	27 N	28 N	24 N
MERCURY	0.02	-	-	-	-
NICKEL	8	17	20	16	21
ZINC	4	81	104	78	98
BARIUM	40	75	86	72	82
IRON	20	24800	32600	23700	30500
MANGANESE	3	1020	1190	987	1070
VANADIUM	10	17	22	17	21
ALUMINUM	40	12800	15600	12000	15000
MAGNESIUM	1000	5310 E	6520 E	5080 E	6130 E
CALCIUM	1000	7250	9060	7620	7820
SEMI-VOLATILE ORGANIC COMPOUNDS (ug/kg)					
BENZO(A)PYRENE	330	-	-	-	-
BENZO(B)FLUORANTHENE	330	-	-	-	-
BENZO(K)FLUORANTHENE	330	-	-	-	-
FLUORANTHENE	330	-	-	-	-
PHENANTHRENE	330	-	-	-	-
PYRENE	330	-	-	-	-
PESTICIDES (ug/kg)					
4,4'-DDT	16	2300	2300 C	3100 C	2800
4,4'-DDE	16	190	180	230	230
4,4'-DDD	16	170	-	130	120
pH, SULFATE, CHLORIDE, FLUORIDE (ug/kg)					
PH		7.7	7.8	7.7	7.9
FLUORIDE		1.4	1.4	1.7	1.7
CHLORIDE		7.3	20	21	13
PERCENT SOLIDS		64	56	61	59

E - INDICATES A VALUE ESTIMATED DUE TO THE PRESENCE OF INTERFERENCE.

N - INDICATES SPIKE SAMPLE RECOVERY IS NOT WITHIN CONTROL LIMITS.

- - ANALYZED FOR BUT NOT DETECTED.

TABLE 6-1 con't.
Summary of Soil Chemical Analysis
Stewart Air National Guard Base

ECJ SAMPLE ID		JTB1021201	JTB1030501	JTB1050701	JTB1060501
COMPUCHEM ID		145950	145573	145545	144195
DATE SAMPLED		08/11/87	08/13/87	08/07/87	08/01/87
DEPTH (ft)		12	5	7	5
MATRIX		SOIL	SOIL	SOIL	SOIL
INORGANIC COMPOUNDS (mg/kg)	DETECTION LIMIT				
ARSENIC	2	3.1 N	-	NA	2.5 N
CADMIUM	1	-	-	NA	1.4
CHROMIUM	2	11	11	NA	24
COPPER	5	27 E	28 E	NA	6.7
LEAD	1	7 N	9.2 N	NA	14 N
MERCURY	0.02	0.12 N	-	NA	-
NICKEL	8	-	16	NA	12
ZINC	4	-	-	NA	48
BARIUM	40	-	-	NA	41
IRON	20	19400	18500	NA	18100
MANGANESE	3	471	575	NA	595
VANADIUM	10	12	12	NA	12
ALUMINUM	40	8190	7940	NA	7950
MAGNESIUM	100	6150 E	4070 E	NA	3470 E
CALCIUM	100	25500	28300	NA	4690
POTASSIUM	100	-	-	NA	837
PCBs (ug/kg)					
AROCLOR-1254	160	210	-	-	-
pH, SULFATE, CHLORIDE, FLUORIDE (mg/kg)					
PH		9.2	8.9	7.7	6.9
SULFATE		590	-	66	-
FLUORIDE		-	-	-	0.29
CHLORIDE		40	14	21	-
PERCENT SOLIDS		90	89	93	84

E - INDICATES A VALUE ESTIMATED DUE TO THE PRESENCE OF INTERFERENCE.
N - INDICATES SPIKE SAMPLE RECOVERY IS NOT WITHIN CONTROL LIMITS.
- - ANALYZED FOR BUT NOT DETECTED
NA - NOT ANALYZED

TABLE 6-1 con't.
Summary of Soil Chemical Analysis
Stewart Air National Guard Base

ECJ SAMPLE ID		JSD1010101	JSD1020101
COMPUCHEM ID		144005	144006
DATE SAMPLED		07/30/87	07/30/87
DEPTH (ft)		1	1
MATRIX		SOIL	SOIL
INORGANIC COMPOUNDS (mg/kg)	DETECTION LIMIT		
ARSENIC	2	3 N	-
CADMIUM	1	-	2.9
CHROMIUM	2	11	8.7
COPPER	10	-	-
LEAD	1	24 N	29 N
MERCURY	0.02	-	0.26 N
NICKEL	8	15	-
ZINC	4	59	43
BARIUM	40	-	-
IRON	20	15900	9650
MANGANESE	3	2310	282
VANADIUM	10	15	-
ALUMINUM	40	7370	6400
MAGNESIUM	1000	2880 E	1990 E
CALCIUM	1000	3430	3980

SEMI-VOLATILE ORGANIC COMPOUNDS (ug/kg)			
BENZO(A)PYRENE	330	260	-
BENZO(B)FLUORANTHENE	330	450	-
BENZO(K)FLUORANTHENE	330	450	-
FLUORANTHENE	330	620	-
PHENANTHRENE	330	500	-
PYRENE	330	540	-

PESTICIDES (ug/kg)			
4,4'-DDT	16	-	-
4,4'-DDE	16	-	-
4,4'-DDD	16	-	-

pH, SULFATE, CHLORIDE, FLUORIDE (ug/kg)			
pH		7.5	7.4
FLUORIDE		0.6	0.67
CHLORIDE		-	-

PERCENT SOLIDS		78	74
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E - INDICATES A VALUE ESTIMATED DUE TO THE PRESENCE OF INTERFERENCE.

N - INDICATES SPIKE SAMPLE RECOVERY IS NOT WITHIN CONTROL LIMITS.

- - ANALYZED FOR BUT NOT DETECTED.

of equipment decontamination (sampler) blanks, trip blanks, and replicate quality control samples. Appendix E also defines each type of data qualifier. Results for the three surface environmental sediment/soil samples and eight subsurface environmental soil samples are summarized in Table 6-1. Data presented in Table 6-1 represent quantifiable results based on review of detection limits, field blanks, laboratory method blanks, and other data qualifiers. Specific qualification of results based on the data review are highlighted in the following discussions of each analyte group.

In general, however, the following conventions were followed in reporting the results. First, results of analysis in which the chemical/element was observed at a level less than the contract required detection limit (CRDL) are not presented in Table 6-1 as quantitative values. Such low concentrations are below levels for which the method has been judged to provide a reliable estimate of concentration but that sufficient analyte appears to be present to identify the compound. In Appendix E, such values are qualified with a "J" flag representing an estimated value for organics, or the symbol "[]" for an inorganic result equal to or greater than the Instrument Detection Limit (IDL) but less than the CRDL.

Secondly, positive results occurring in method blanks were assessed and the field results were corrected as appropriate (in accordance with CLP procedures) to adjust for contamination introduced during handling. This type of blank contamination is frequently observed in GC/MS analyses at trace levels for chemicals such as phthalate esters, which are ubiquitous wherever plastic

equipment is used, or other common volatile laboratory reagent chemicals, such as acetone, toluene, and methylene chloride.

Blank contamination occurs as a laboratory artifact due to the presence of solvents in the laboratory atmosphere, during decontamination of equipment, or from contact with plasticizers. For such common contaminants observed in the method blanks, CLP guidelines indicate that the detection limit should be revised to a value 10 times the observed contamination level. Much less frequently, blanks have been observed to be contaminated by other HSL or non-HSL chemicals. For these chemicals, the guidelines indicate a revision of the detection limit by a factor of 5 times the observed value.

6.5.1 Inorganic Chemicals

Results of metals analyses indicate that the major cation constituents of soil (i.e., calcium, magnesium, aluminum, and iron) were present in surface and subsurface soils at levels typical of unconsolidated sediment matrices, and that other metals (i.e., arsenic, cadmium, chromium, lead, mercury, and zinc) were found at low to sub-mg/kg levels. Beryllium was detected in several samples but below the CRDL (see Appendix E). None of the metals were observed to exceed concentrations normally associated with background soil values. Ranges cited by two authors for cation/metal content of soil (mg/kg) are as follows:

	<u>Lindsay (1979)</u>	<u>Swain (1955)</u>
Arsenic	0.1 - 40	Not Given
Beryllium	Not Given	3 - 40
Cadmium	0.01 - 7	0.01 - 7
Chromium	1 - 3000	5 - 1000
Copper	2 - 100	2 - 100
Lead	2 - 200	2 - 200
Mercury	0.01 - 0.50	0.02 - 0.2
Nickel	5 - 1000	10 - 1000
Zinc	10 - 300	10 - 300
Barium	100 - 3000	Not Given
Iron	7000 - 500,000	50,000 - 300,000
Manganese	20 - 3000	200 - 2000
Vanadium	Not Given	20 - 500
Aluminum	10,000 - 300,000	Not Given
Magnesium	600 - 6000	Not Given
Calcium	7000 - 550,000	Not Given
Potassium	400 - 30,000	Not Given

Sulfate concentration and pH were elevated in soil samples from JMW-101 and JTB-102. The pH was also elevated in JMW-108 soil samples.

6.5.2 Organic Chemicals

No VOCs were observed at concentrations greater than the CRDL in either the subsurface or surface soil/sediments. As shown in Appendix E, methylene chloride and acetone were observed in method blanks as well as in several samples, but at different levels, which suggests that the observed occurrence is an artifact of sample handling or laboratory analysis. Benzene was also identified in two samples (i.e., JMW-107 and JSD-100 MSD) at levels below the CRDL of 5 ug/kg (see Appendix E). This analyte was also identified in the method blank at 1.5 ug/kg. Sample JSD-100 MSD was one of four replicates at sediment/soil sampling location JSD-100. Benzene was not identified in the other three replicates for that sample. In JMW-107 soil, the benzene

concentration reported was 1.7 µg/kg, which is equivalent to the blank level. Although benzene is a carcinogen, its appearance in the blanks at levels similar to the two samples and its distribution in only one of four replicates indicate that its occurrence is not an environmental contaminant, but rather an artifact of the sampling and analysis process.

Chloroform was identified below the CRDL in five of the eight subsurface soil samples and in one soil/sediment sample replicate (JSD-100 MSD) from sediment sample location JSD-100. Toluene was detected below the CRDL in JTB-103. Both analytes are common sample handling artifacts; however, no evidence of method blank contamination was observed. Three locations where these contaminants were observed are below the land surface hydraulically upgradient of the landfill.

Three phthalate esters (i.e., diethyl phthalate, bis(2-ethylhexyl)phthalate [BEHP], and di-n-butyl phthalate) were identified in the subsurface soil samples, as well as the surface soil/sediment (see Appendix E). BEHP and diethyl phthalate were identified in the laboratory method blanks. None of the values tabulated in Appendix E are greater than the CRDL, as modified to account for blank contamination. Di-n-butylphthalate was not observed in samples at greater than 25 percent of the CRDL. Because of these factors, the phthalate esters are not included in Table 6-1. Phthalate esters are common artifacts of sample handling due to their widespread use as plasticizers and occurrence on sample handling and protective equipment. Because of the sporadic identification of these analytes in the environmental samples and their occurrence in method and sample blanks, their presence in the soil as

contaminants is questionable.

Polynuclear aromatic hydrocarbons (PAHs) were observed at one surface soil/sediment sample location (JSD-101, at the toe of the landfill), but not in the subsurface or other sediment sampling locations. Five PAH species (listed in Table 6-1) were identified and quantified in JSD-101. Concentrations of the species quantified ranged from 450 to 620 $\mu\text{g/kg}$; the CRDL is 330 $\mu\text{g/kg}$. An additional five species were identified at this location but at levels lower than the CRDL: acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, and chrysene. PAHs are multi-ringed aromatic compounds that generally result from the incomplete combustion of hydrocarbons, in coal, or the weathering of petroleum products. PAHs are widely distributed in soils as a result of deposition of unburned combustion products, vehicle exhaust, and the natural consequence of wildfires. In general, such distribution results in the sporadic occurrence of numerous species of PAHs at levels less than 1,000 to 5,000 $\mu\text{g/kg}$. Higher concentrations of PAHs occur as a result of contamination due to wastes from activities such as coke manufacture, creosote, ash disposal, and coal tar.

Two subsurface soil samples (i.e., JMW-101 at 31 feet and JTB-102 at 12 feet) contained PCBs, identified as Arochlor-1254, at concentration levels just above the CRDL. Review of the chromatographic results and quality control data indicated that the analyte was accurately identified and quantified. PCBs are generally associated with the disposal of transformer oil. These compounds are extremely insoluble and tend not to migrate in soils as a result of leaching. Their presence at depths greater than 10 feet in two borings, located far from

a likely source and upgradient of the landfill, is difficult to explain based on the behavior of PCBs in the environment.

The pesticide residues 4,4-DDT, 4,4-DDE, and 4-DDE were identified in each of four replicate samples from the sediments of the small shallow pond location JSD-100. The compounds 4,4-DDT and 4,4-DDE generally occur as transformation products or impurities in the pesticide DDT. As shown in Table 6-1, two of the four results were confirmed by GC/MS analysis. The location of JSD-100 is in the surface drainage pathway downslope from the pesticide burial pit. The presence of these compounds in the sediments indicates present or past migration, most likely via transport of contaminated soil particles. Chlorinated pesticide residues such as DDT, DDE, and DDD are strongly sorbed to particulate matter and have a very low water solubility. DDT was identified in the surface water at the JSW-100 sample location (see Section 8.3) and in the pesticide burial site. Except in the immediate area of the pesticide pit, no DDT or transformation products were identified at any other soil sample locations or in the groundwater. Pesticides associated with the pesticide pit are discussed in Section 10.0.

7.0 GROUNDWATER

Characterization of the site hydrogeologic conditions and groundwater quality is designed to: (1) evaluate groundwater movement in the strata beneath the site, and (2) identify pathways for contaminant migration in groundwater. The interpretation of groundwater conditions is based on water level observations in monitoring wells and piezometers installed at the site, geology, and permeability data. Assessment of the site groundwater quality is based on water quality determinations from the monitoring wells screened in the glacial till. The exploration program, hydrogeological conditions, and sampling and analytical results are discussed in this section.

7.1 MONITORING WELLS AND PIEZOMETERS

Twenty-five multilevel piezometers were installed in single boreholes at 11 boring locations (see Section 6.1.2). Three boring locations had three piezometers each and eight locations had two piezometers each. The purpose of the piezometers was to provide water level data. Four groundwater quality monitoring wells were installed in separate boreholes at four boring locations. The monitoring wells provided access to groundwater for obtaining water level measurements, permeability data, and water samples for laboratory analyses. Groundwater is monitored by four monitoring wells and piezometers in the ablation till; by nine monitoring wells and piezometers in the underlying basal

till; by four piezometers at the shale/till contact; and by 12 piezometers in the shale bedrock.

Screen monitoring depths for the piezometers and monitoring wells range from 2.5 to 61.5 feet and 4.3 to 32.5 feet below the ground surface, respectively. Installation locations are shown in Figure 6-1. The monitoring wells and piezometers consisted of Schedule 40 polyvinyl chloride (PVC) material and were 2-inch and 3/4-inch ID, flush-threaded, joint casing, respectively. Screen slot width in both types of installation was 0.01-inch. Installation details at each location are presented in the boring logs in Appendix B and in Table 7-1.

Well screens were backfilled with clean silica sand to a depth of 1.5 to 4 feet above the screened interval. The augers or steel casing were raised so that only the clean silica sand would occupy the annular space around the well screen. Above the sandpack, wells and piezometers had a minimum 2-foot-thick bentonite pellet seal. A cement plug and locking steel protective casing were installed at the ground surface for monitoring wells and piezometers.

In September 1987, Jordan personnel surveyed the locations of the subsurface explorations and ground elevations of the borings, and measured elevations of the uncapped tops of casing. Horizontal locations and elevations were determined to the nearest 1.0 foot and 0.01 foot, respectively. Jordan developed the monitoring wells and piezometers by periodically removing formation water by pumping and then allowing the water levels to recover. Well development

TABLE 7-1

MONITORING WELL AND PIEZOMETER INSTALLATION DETAILS
STEWART ANGB, NEW YORK

BORING* NUMBER	GROUND SURFACE ELEVATION	TOP OF CASING ELEVATION	PVC RISER ELEVATION	EFFECTIVE** MONITORING INTERVAL	BOTTOM OF SCREEN ELEVATION	SCREEN LENGTH IN FEET	BEDROCK SURFACE ELEVATION	GEOLOGIC MATERIAL
JTB-100A	433.93	436.6	436.06	378.3 - 385.3	381.4	2	388.3	Shale
JTB-100B			436.29	388.4 - 393.9	389.4	2		Basal Till
JTB-101A	437.64	440.15	439.50	391.2 - 395.6	392.6	2	399.9	Shale
JTB-101B			439.65	399.9 - 403.6	400.6	2		Basal Till
JMW-101	437.83	440.21	440.00	404.9 - 417.6	405.1	10		Basal Till
JTB-102A	427.62	430.36	430.27	366.0 - 374.6	368.1	2	376.0	Shale
JTB-102B			430.37	376.6 - 392.6	377.6	2		Basal Till
JTB-102C			430.27	398.6 - 417.6	413.6	2		Basal Till
JTB-103A	432.54	435.48	434.56	381.1 - 386.0	381.3	2	390.0	Shale
JTB-103B			434.71	388.5 - 394.3	390.7	2		Shale/Till
JTB-104A	435.54	437.95	437.62	398.5 - 402.9	398.7	2	411.0	Shale
JTB-104B			437.69	405.0 - 413.0	409.3	2		Shale/Till
JTB-104C			437.69	415.0 - 423.5	419.5	2		Basal Till
JTB-105A	392.69	394.57	394.23	354.7 - 358.7	355.2	2	367.2	Shale
JTB-105B			394.43	366.4 - 369.7	366.7	2		Basal Till
JTB-105C			394.57	375.5 - 379.0	375.7	2		Ablation Till
JTB-106A	386.97	389.95	389.78	357.0 - 361.7	359.0	2	367.5	Shale
JTB-106B			389.88	367.5 - 371.0	368.0	2		Basal Till
JTB-107A	364.79	367.99	367.15	345.4 - 350.8	346.8	2	355.4	Shale
JTB-107B			367.72	356.8 - 360.8	357.2	2		Ablation Till
JMW-107	364.14	367.43	367.21	354.6 - 361.6	354.6	5		Ablation Till
JTB-108A	367.34	370.25	370.10	350.5 - 344.3	345.8	2	354.5	Shale
JTB-108B			370.21	352.5 - 358.5	354.8	2		Basal Till
JMW-108	368.34	370.85	370.73	356.3 - 364.1	356.8	5		Basal Till
JTB-109A	371.72	374.01	374.01	352.3 - 356.5	352.3	2	361.3	Shale
JTB-109B			374.02	358.7 - 366.4	361.9	2		Basal Till
JMW-109	372.02	374.45	374.32	361.0 - 368.0	361.0	5		Basal Till
JTB-110A	361.34	364.22	363.88	335.1 - 340.3	336.8	2	342.4	Shale
JTB-110B			363.98	344.3 - 348.3	345.3	2		Basal Till

NOTE:

*JTB = Test boring with multiple piezometer installations JMW = Test boring with monitoring well installation
 **Interval includes total sandpack length and any caved intervals

continued until the discharged groundwater from the monitoring wells was free of sediment.

7.2 PERMEABILITY TESTING

On September 11, 12, and 13, 1987, Jordan personnel conducted rising-head permeability tests on the four monitoring wells to determine the hydraulic conductivity of the glacial till. No permeability tests were conducted in the shallow bedrock. The testing consisted of depressing the water level in each of the monitoring wells by pumping and then measuring the rate of water level recovery. Due to the small amount of standing water in the wells under static conditions and the relatively rapid response, water levels at the start of testing ranged from only 1.41 to 5.10 feet below static. The time required for the water levels to recover ranged from 20 to 45 minutes.

Table D-1 in Appendix D presents field data from the rising-head permeability tests conducted in each monitoring well. Table 7-2 indicates that the average value of hydraulic conductivity for the basal till was 4.19×10^{-5} cm/sec with a range of 2.24×10^{-5} to 5.19×10^{-5} cm/sec. The one hydraulic conductivity value measured for the ablation till was 4.20×10^{-5} cm/sec. These values represent horizontal hydraulic conductivities for glacial till at depths from 2.5 to 32.5 feet below the ground surface, indicating that the horizontal hydraulic conductivity is consistent across the site, regardless of till type and soil depth.

TABLE 7-2

HYDRAULIC CONDUCTIVITY RESULTS

WELL	GEOLOGIC MATERIAL	K	HEAD DEPRESS (FT.)	SCREEN DEPTH (FT.)
JMW-101	Basal Till	2.24×10^{-5} cm/s	1.41	20-32.5
JMW-107	Ablation Till	4.20×10^{-5} cm/s	1.98	2.5-9.5
JMW-108	Basal Till	5.13×10^{-5} cm/s	5.1	4.3-12.0
JMW-109	Basal Till	5.19×10^{-5} cm/s	2.04	8.0-22.0

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0004.0.0

7.3 WATER LEVEL OBSERVATIONS

Jordan periodically measured groundwater levels in the monitoring wells and piezometers during the exploration program. This information was obtained to construct a groundwater surface contour map, from which hydraulic gradients and flow directions were determined (see Section 7.4). Complete sets of water level measurements for monitoring wells and piezometers installed at the site were taken on September 14, October 2, and October 14, 1987 (Table 7-3). The water level data show fluctuations through the period of measurements. Low water levels were recorded on October 14 in piezometers JTB-100B and JTB-103A and on October 2, 1987, in piezometers JTB-102B, JTB-105A, and JTB-105B. Water levels measured on October 14, 1987, in JMW-109, JTB-109B, and JTB-102C (all in shallow till) were high. These water level fluctuations are common in tills, due to low permeability and variable recharge conditions following rainfall events.

7.4 HYDROGEOLOGY

7.4.1 Regional Hydrogeology

Based on regional geology and topography, Jordan interprets that the groundwater movement at the site occurs primarily in the glacial till and in the underlying sedimentary rocks (predominantly shale). Based on elevations of surface water bodies located in the vicinity of the site, the regional groundwater flow pattern is southeast toward the Hudson River.

TABLE 7-3

WATER LEVEL OBSERVATIONS
STEWART ANGB, NEW YORK

LOCATION	CASING ELEVATION	9/11/87 DEPTH	9/11/87 ELEVATION	9/14/87 DEPTH	9/14/87 ELEVATION	10/2/87 DEPTH	10/2/87 ELEVATION	10/14/87 DEPTH	10/14/87 ELEVATION
MW-101	440.21	10.58	429.63	31.44	408.77	11.21	429	8.38	431.83
MW-107	367.43	10.25	357.18	10.55	356.88	10.73	356.7	8.43	359.0
MW-108	370.85	8.5	362.35	8.7	362.15	8.58	362.27	8.71	362.14
MW-109	374.45	10.05	364.4	10.12	364.33	8.36	366.09	4.97	369.48
JTB-100A	436.6	--	--	--	--	31.58	405.02	31.9	404.7
JTB-100B	436.6	--	--	14.0	422.6	31.45	405.15	32.28	404.32
JTB-101A	440.15	33.6	406.55	36.61	403.54	32.81	407.34	33.74	406.41
JTB-101B	440.15	33.56	406.59	36.61	403.54	32.8	407.35	33.7	406.45
JTB-102A	430.36	--	--	37.68	392.68	37.07	393.29	37.01	393.35
JTB-102B	430.36	--	--	35.19	395.17	37.18	393.18	33.59	396.77
JTB-102C	430.36	--	--	14.35	416.01	14.18	416.18	12.96	417.4
JTB-103A	435.48	--	--	14.85	420.63	30.69	404.79	31.62	403.86
JTB-103B	435.48	--	--	15.36	420.12	30.53	404.95	31.53	403.95
JTB-104A	437.95	--	--	24.13	413.82	23.76	414.19	23.12	414.83
JTB-104B	437.95	--	--	23.89	414.06	23.42	414.53	22.8	415.15
JTB-104C	437.95	--	--	18.07	419.88	17.4	420.55	13.89	424.06
JTB-105A	394.57	17.94	376.63	18.21	376.36	17.93	376.64	18.32	376.25
JTB-105B	394.57	17.27	377.3	17.45	377.12	15.59	378.98	17.32	377.25
JTB-105C	394.57	113.61	280.96	13.91	380.66	14.31	380.26	12.52	382.05
JTB-106A	389.95	18.63	371.32	18.71	371.24	18.19	371.76	18.56	371.39
JTB-106B	389.95	18.27	371.68	18.2	371.75	17.85	372.1	18.18	371.77
JTB-107A	367.99	11.45	356.54	11.62	356.37	11.69	356.3	10.07	357.92
JTB-107B	367.99	11.45	356.54	11.62	356.37	Dry	--	9.6	358.39
JTB-108A	370.25	9.52	360.73	9.67	360.58	9.44	360.81	9.57	360.68
JTB-108B	370.25	9.8	360.45	10.08	360.17	9.53	360.72	9.76	360.49
JTB-109A	374.01	9.82	364.19	9.93	364.08	8.1	365.91	5.2	368.81
JTB-109B	374.01	9.82	364.19	9.96	364.05	8.24	365.77	4.53	369.48
JTB-110A	364.22	17.91	346.31	18.04	346.18	17.86	346.36	17.37	346.85
JTB-110B	364.22	18.03	346.19	18.05	346.17	17.96	346.26	17.47	346.75

7.7 RESULTS OF GROUNDWATER ANALYSES

Table 7-4 summarizes groundwater sampling from each of the four monitoring wells (see Figure 6-1). Each sample was analyzed for the metals, VOCs and SVOCs, organophosphate, and HSL chlorinated pesticides, herbicides, and PCBs. Analyses were performed in accordance with CERCLA-SARA National CLP protocols (either CLP-COP or CLP-CIP), as well as for the chloride, fluoride, and sulfate anions and for pH. VOCs and SVOCs were analyzed by GC/MS, while pesticides, herbicides, and PCBs were analyzed only by GC. Metals were analyzed by either atomic absorption or plasma emission spectroscopy; and anions were analyzed by wet chemical methods.

The complete data base is included in Appendix E, and contains all positive results, qualification flags, results of sampling and trip blanks, and results of duplicate analysis. Table 7-4 represents the results of assessing the data in accordance with USEPA functional guidelines for quantification and positive identification (see Section 6.5). The following paragraphs summarize the findings and qualification of the groundwater monitoring data.

Table 7-4 also shows the major cation content (i.e., calcium, magnesium, sodium, and potassium) of groundwater. JMW-101, located upgradient, was found to have generally higher levels of major cations, particularly divalent ions, than the three downgradient samples. Manganese was relatively high in all wells except JMW-107. Compared to data typical of wells downgradient of a landfill, iron concentrations were extremely low. The only trace metal observed at concentrations above the CRDL was mercury in JMW-108. As shown in

TABLE 7-4
Summary of Groundwater Chemical Analysis
Stewart Air National Guard Base

ECJ SAMPLE ID		JMW101XX01	JDUP-1XX01	JMW107XX01	JMW108XX01	JMW108R101
COMPUCHEM ID		150770	150759	150746	150751	150752
DATE SAMPLED						
MATRIX	(ug/l) DETECTION LIMIT	WA	WA	WA	WA	WA
INORGANIC COMPOUNDS (ug/l)						
CALCIUM	5000	360000	128000	204000	212000	210000
IRON	100	466	112	-	154	206
MAGNESIUM	5000	89900	17800	19400	27700	27300
MANGANESE	15	2750	9430	160	5940	5240
MERCURY	0.2	-	-	-	-	-
SODIUM	5000	117000	46400	35700	101000	98500
VOLATILE ORGANIC COMPOUNDS (ug/l)						
1,1,1-TRICHLOROETHANE	5	-	-	8.6	-	-
SEMI-VOLATILE ORGANIC COMPOUNDS (ug/l)						
BIS-(2-ETHYLHEXYL)PHTHALATE	10	-	-	-	-	-
pH, SULFATE, CHLORIDE, FLUORIDE (mg/l)						
pH		6.8	6.4	6.7	6.6	-
SULFATE		1300	40	45	60	-
FLUORIDE		0.16	0.16	0.1	0.12	-
CHLORIDE		11	67	54	250	-

- - ANALYZED FOR BUT NOT DETECTED
NR - NOT REQUESTED

TABLE 7-4 con't.
Summary of Groundwater Chemical Analysis
Stewart Air National Guard Base

ECJ SAMPLE ID		JMW108R201	JMW108R301	JMW109XX01
COMPUCHEM ID		150765	150756	150762
DATE SAMPLED				
MATRIX	(ug/l)	WA	WA	WA
	DETECTION			
	LIMIT			
INORGANIC COMPOUNDS (ug/l)				
CALCIUM	5000	213000	211000	128000
IRON	100	131	-	-
MAGNESIUM	5000	28100	27000	17700
MANGANESE	15	5800	5660	9150
MERCURY	0.2	-	7.5	-
SODIUM	5000	100000	101000	45900
VOLATILE ORGANIC COMPOUNDS (ug/l)				
1,1,1-TRICHLOROETHANE	5	-	-	-
SEMI-VOLATILE ORGANIC COMPOUNDS (ug/l)				
BIS-(2-ETHYLHEXYL)PHTHALATE	10	-	26	-
pH, SULFATE, CHLORIDE, FLUORIDE (mg/l)				
pH		-	-	6.5
SULFATE		-	-	40
FLUORIDE		-	-	0.22
CHLORIDE		-	-	68

- - ANALYZED FOR BUT NOT DETECTED
NR - NOT REQUESTED

Table 7-4, four replicate samples were analyzed from this well (i.e., JMW108XX01, JMW108R101, JMW108R201, and JMW108R301); only one replicate contained mercury, and it was at a high level relative to the CRDL. This finding probably reflects contamination of the sample during handling. Arsenic, barium, and zinc were detected in the monitoring wells at levels below the CRDL (see Appendix E). The CRDLs for these compounds in groundwater are as follows:

Arsenic	10 µg/l
Barium	200 µg/l
Zinc	20 µg/l

Chloride concentration was high in the sample from JMW-108, but not from other monitoring wells downgradient of the landfill. Groundwater having a chloride concentration exceeding 250 mg/l and exceeding 1,000 mg/l total dissolved solids is considered to be naturally saline, according to New York groundwater quality standards (NYCRR 703). Based on the observed concentrations of other anions and cations, it is unlikely that the total dissolved solids content in JMW-108 exceeds 1,000 mg/l. It is possible that elevated chloride in this well is due to the presence of leachate from the landfill, although iron is not elevated and pH is not highly acidic, as might also be expected.

Reportedly, sulfuric acid (up to 10 gallons) was disposed of in the pesticide pit. Sulfate concentration in JMW-101 (located near the pit) is 1,300 mg/l, which is extremely high for non-saline groundwater. Based on available hydrogeologic data, the high sulfate content in this sample cannot be explained, since interpreted groundwater contours indicate that the well is hydraulically

upgradient. However, the soil sample collected at a depth of 31 feet below the land surface at JMW-101 contained 1,100 mg/kg of sulfate.

Several VOCs were identified in the groundwater from the downgradient wells (i.e., JMW-107, JMW-108, and JMW-109). Except for 1,1,1-trichlorethane observed at 8.6 µg/l in JMW-107, all identified analytes were below the CRDL. Complete results are presented with qualification flags in Appendix E. Methylene chloride, identified in all samples, blanks, and method blanks, is a common laboratory solvent and occurs frequently as an artifact introduced during the sampling and analysis process. Because of its occurrence at similar levels in all samples and blanks, it is concluded that the methylene chloride found in the groundwater samples was an introduced contaminant, and was unlikely to be present in the groundwater at levels shown in Appendix E.

As shown in Appendix E, nine HSL VOCs, in addition to methylene chloride, were identified in the groundwater samples. Except for acetone in the duplicate (JDUP-1XX01) samples from JMW-109, the other analytes identified were the following halogenated hydrocarbon residues: 1,1,1-trichloroethane, chloromethane, 1,1-dichloroethane, bromomethane, trans-1,2-dichloroethene, vinyl chloride, chloroform, and chloroethane.

Because each compound was identified at a low level, the GC/MS data were reviewed to assess the accuracy of the identifications based on retention times and spectral matching of sample data with standards, as well as other quality control data. The data indicate that low concentrations of three halocarbon residues are migrating from the landfill. The upgradient well (i.e., JMW-101)

contained only traces of chloroform. Chloroform was not detected in the blanks associated with the data set. It is a common laboratory solvent, however, and is generated in chlorinated potable water. The presence of chloroform in JMW-101 may or may not be related to environmental contamination.

JMW-107, JMW-108, and JMW-109 contained solvent residues. The only contaminant identified in JMW-107 was 1,1,1-trichloroethane at a concentration of 8.6 µg/l. The residue 1,1-dichloroethane was observed in JMW-108 and two of three replicates from JMW-108. 1,1-Dichloroethane is recognized as a transformation product of 1,1,1-trichloroethane. It is not a commonly used solvent. JMW-109 and the duplicate of that sample contained a number of VOCs at concentrations below the CRDL. Vinyl chloride was identified in one replicate. The comparability of results (see Appendix E) for four of the eight identified compounds, and the occurrence of seven different residues in one replicate and four in the other, indicate migration of VOCs from the landfill.

BEHP was identified at 26 µg/l in one replicate, and below the CRDL in the sample and each of the remaining two replicates of JMW-108. In JMW-109, BEHP was below the CRDL. No other SVOCs, pesticides, herbicides, or PCBs were identified in groundwater at this site. As indicated in Section 6.5, phthalate esters are commonly observed as sampling artifacts because of their widespread occurrence in plastic materials, as well as in sample handling and protective equipment. No BEHP was detected in the laboratory method blank. However, analysis of the sampler blank showed this compound identified below the CRDL, suggesting the possibility that some, if not all, of the BEHP may be an arti-

fact of sampling. Phthalate esters, however, are also commonly observed as components of landfill leachate.

8.0 SURFACE WATER

8.1 LOCAL AND REGIONAL WATERSHEDS

Surface water runoff in the Stewart ANGB area flows in an east and southeast direction. Runoff is moderately high because of the runway surfaces and predominantly glacial till type of soils. Most runoff from the existing runway facility is collected in a storm drainage system and discharged to the southeast into Recreational Pond. This water flows southward via an unnamed tributary to Silver Stream, then eastward as Silver Stream to a diversion structure, where it flows northward into Lake Washington.

All water in Silver Stream, except during periods of flooding, enters Lake Washington. Floodwaters that pass the diversion structure flow southeastward to Moodna Creek. Surface water along the eastern perimeter of the ANGB facility, outside the storm drainage system, moves as sheet flow toward the east, including the area in and around the former landfill and pesticide burial site. This sheet flow runoff enters Murphy's Gulch, a tributary of Quassaic Creek. The Murphy's Gulch portion of the drainage receives runoff from the former landfill and pesticide burial site areas, as well as from the former New Windsor Landfill off Liner Road. This drainage flows northward and eastward, crossing the thruway. At Union Avenue (Route 300), Murphy's Gulch passes through Murphy's Gate, a diversion structure formerly used to route surface water to Lake Washington. This gate has been closed for several years. The water then continues eastward, via the natural channel, to Brookside Pond and

Quassaic Creek. Both Moodna and Quassaic creeks are tributaries to the Hudson River.

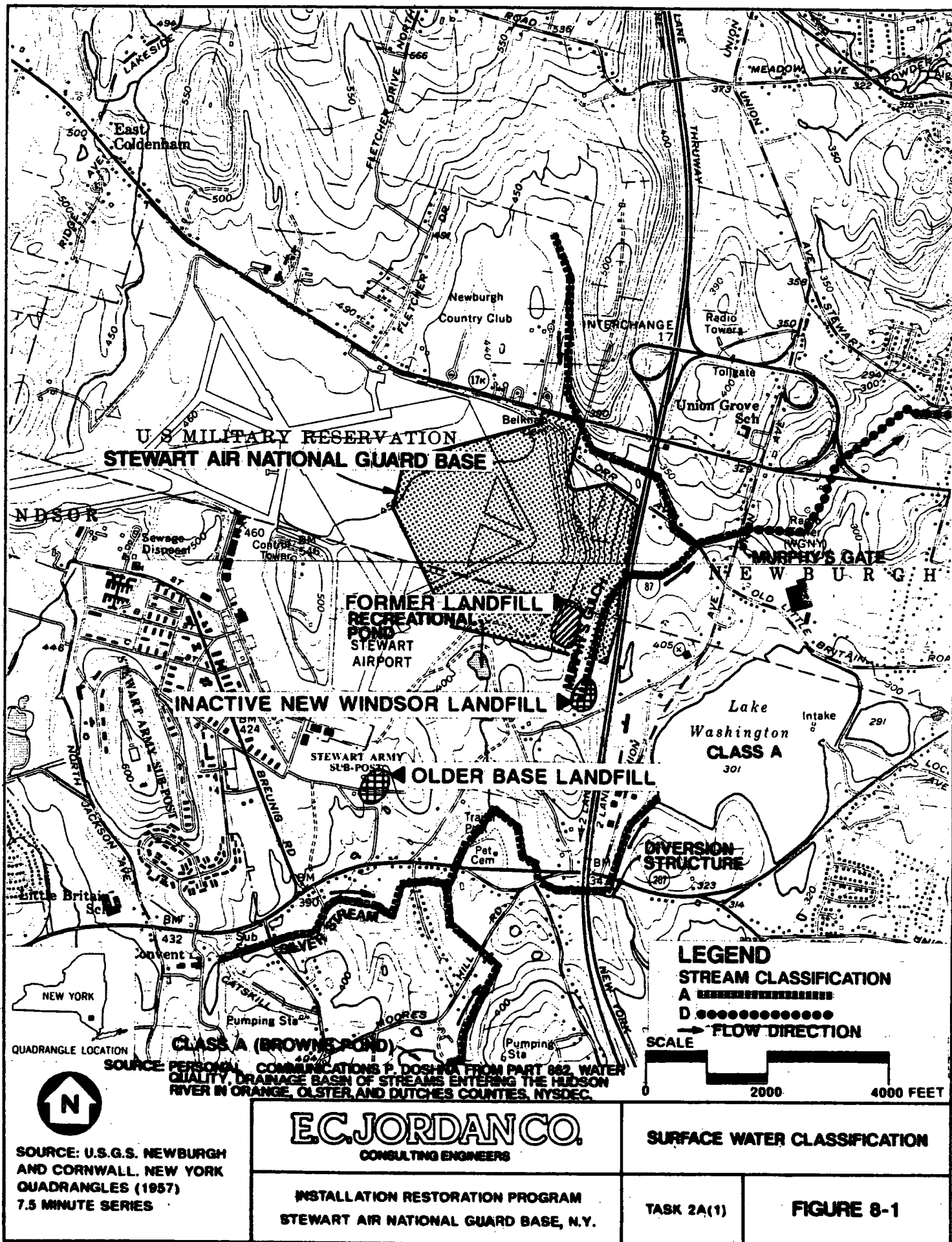
No natural surface water bodies were observed within the site study area. A small enclosed depression, part of a manmade drainageway, occurs along the northeastern perimeter of the landfill. While this depression, approximately 100 to 200 square feet in area, is assumed to be intermittent, it had standing water in the bottom whenever field activities were conducted. The standing water was never observed to be more than 4 to 6 inches deep. Surface runoff from the northern portion of the landfill and surrounding natural undisturbed surface flows through this drainageway. Sediment samples and one surface water sample were collected from this area.

8.2 SURFACE WATER CLASSIFICATION

The surface water bodies in the area have been assigned several use classifications by NYSDEC (Figure 8-1). NYSDEC categorized the best usage and related conditions for these waters as:

- o Class A - Protection for drinking water supply
- o Class C - Protection for fishing and fish propagation
- o Class D - Protection for fishing and fish survival

Surface water in Silver Stream above the diversion structure to Lake Washington and Murphy's Gulch, above the diversion known as Murphy's Gate at Union Avenue, is Class A. Surface water downstream from Murphy's Gate to Brookside Pond is



Class D. Brookside Pond (not shown in Figure 8-1) water is Class C, while both Lake Washington and Brown's Pond are Class A.

8.3 RESULTS OF SURFACE WATER ANALYSIS

The single surface water sample (JSW-001) was analyzed for the metals, VOCs and SVOCs, organophosphate, and HSL chlorinated pesticides, herbicides, and PCBs. In addition, the sample was analyzed for chloride, fluoride, and sulfate in accordance with CERCLA-SARA National CLP protocols (either CLP-COP or CLP-CIP). VOCs and SVOCs were analyzed by GC/MS. Pesticides, herbicides, and PCBs were analyzed by either atomic absorption or plasma emission spectroscopy. Anions were analyzed by wet chemical methods (see Appendix E). As described in Section 6.5, Appendix E data contain positive results, qualification flags, and results of sampling and trip blanks. These data were reviewed in accordance with USEPA functional guidelines for quantification and identification. Summarized quantified results are as follows:

<u>Analyte</u>	<u>CRDL</u>	<u>Result of Analysis</u> <u>Sample JSW001XX01</u>
<u>Inorganic Compounds (ug/l)</u>		
Aluminum	200	739
Calcium	5000	13,500
Iron	100	1460
Magnesium	5000	34,800
Manganese	15	87
Sodium	5000	18,900
Chloride	Not Applicable	42
Fluoride	Not Applicable	0.2
Sulfate	Not Applicable	320
pH	Not Applicable	6.8

Pesticides/PCBs (ug/l)

4,4'-DDT	0.1	0.57
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The only metals detected at concentrations greater than the CRDL were the major cations species, which are generally found in any surface water. As indicated in Appendix E, arsenic, barium, copper, and zinc were identified, but at concentrations less than their respective CRDL. Zinc was identified at 20 ug/l (the CRDL level). However, because the method blanks contained zinc at 4.2 ug/l, the revised detection limit for zinc must be set at 42 ug/l. Because zinc is so commonly used as a coating for other metals, it is widely distributed in the laboratory environment, and trace levels of blank contamination are common laboratory artifacts.

Sulfate concentration was an order of magnitude higher than the concentrations observed in the site groundwater (except JMW-101). Because of the turbid nature of the samples, there was high probability that the sulfate result would show a large positive interference.

HSL VOCs or SVOCs were not identified in the surface water sample, except for methylene chloride, which was also detected at similar levels in blanks. Therefore, it has been concluded that the methylene chloride, identified in the water samples at Stewart ANGB, is an artifact of the sampling and analysis process (see Section 7.7).

The chlorinated pesticide 4,4'-DDT was identified in the surface water sample at 0.57 ug/l. As indicated in Section 6.5, the sediments in this shallow water body were also contaminated with DDT residues. Because of the strong sorptive tendencies of DDT for particulate matter and the turbid nature of the shallow pond, it is likely that the DDT detected was predominantly sorbed to particulate matter. This finding suggests potential pesticide residue migration from the pesticide pit area via surface drainage or the erosion channel.

9.0 AIR

Reconnaissance of the site and the known use of the site did not indicate the likelihood of an air emissions problem from VOC contamination in soils. Therefore, a specific program of air sampling and analysis was not implemented. Analyses of surficial and subsurface soils, surface water, and groundwater confirm the low potential for VOC emissions.

Air quality at the former landfill and pesticide burial site was monitored for VOC emissions with a Photovac TIP PI meter during subsurface explorations. Ambient air, borehole headspace, and soil sample headspace were monitored. None of the samples of surface soil or upper soil layers (of the subsurface) yielded PI meter readings above background. One reading, slightly above ambient air background levels, was detected within the sample spoon (JTB1070401) and in the reference jar headspace for a sample at a depth of 4 to 5 feet below the land surface. No other subsurface samples yielded PI meter readings above background, and no ambient air VOC levels were detected around JTB-107.

10.0 ABOVE AND BELOW GROUND STRUCTURES

The former landfill and pesticide burial site are situated on natural soils that were modified during construction of the airfield and disposal operations. Based on the background review and visual reconnaissance performed for this investigation, no structures, above or below ground, were constructed for these activities. The background review, including aerial photographic interpretation of the area, indicates that the landfill and pesticide burial activities involved the excavation of several trenches and at least one pit for the disposal of materials (see Section 3.2). To evaluate the site as a continuing source of contamination, these trenches and pesticide pits should be considered potential "leaky containers" of concentrated residual materials from the landfill operation.

The pesticide pit located north of the landfill (see Figure 1-3) was investigated by Dames and Moore (Dames and Moore, 1985 and 1986). In 1984 and 1985, two sets of test pits were installed following a metal detector and magnetometer survey to locate and define the pesticide pit boundaries. Dimensions of the pit were estimated to be 15 by 25 feet. Approximately 40 five-gallon containers (200 gallons) of pesticide and 10 gallons of acid solution were estimated to be buried at depths up to 10 feet.

The primary pesticide found in the Dames and Moore study was DDT. The pesticide containers were observed to be crushed and leaking. Six samples of the oily liquid waste contained DDT at concentrations up to 12 percent (wt/v).

Soils from test pits installed in the disposal area contained DDT levels up to 1.3 percent (w/w). DDE and DDD were found at slightly lower levels. The second most prevalent residues were the chlorinated phenoxy herbicides 2,4-D and 2,4,5-T, found at less than one part per million (ppm) in the soils and/or oily waste.

Based on the finding of containers of hydrofluoric, sulfuric, and hydrochloric acids; DDT; parathion; heptachlor; and 2,4-D, 2,4,5-T, and 2,4-D/2,4,5-T mixtures, monitoring wells were installed approximately 30 and 100 feet downgradient and approximately 100 feet upgradient of the pit. The approximate locations of monitoring wells installed by Dames and Moore are shown in Figure 1-3. The upgradient and nearest downgradient wells were screened in the zone of weathered shale bedrock at depths of 39.4 and 35.1 feet below the land surface, respectively. The well located 100 feet downgradient was screened at a depth of 36.4 feet to intercept both the upper layers of the rocks and the overlying till. These wells were screened in the upper portion of the groundwater table. In the closest downgradient well (SW-2), soil samples were analyzed for pesticides from the top of the screened interval and from a depth of 25 feet below the land surface, at a soil interval from which high readings of organic vapors were measured (using a portable GC equipped with a PI detector).

Table 10-1 summarizes results of analysis of samples collected by Dames and Moore in October 1985. These data show that pesticide residues were present in the subsurface soils at ppm levels, and in the groundwater at parts per billion (ppb) levels within 30 feet of the pit. This indicates that migration occurred

TABLE 10-1

SUMMARY OF PESTICIDE CONCENTRATION RANGES
RESIDUAL WASTE, TEST PIT SOILS, SUBSURFACE SOILS, AND GROUNDWATER

RESIDUE	RANGE OF CONCENTRATIONS (OCCURRENCE/NUMBER OF ANALYSES)							
	OILY		TEST		SUBSURFACE			
	LIQUID WASTE (mg/l)		PIT SOILS (mg/kg)		SOILS (mg/kg)		GROUNDWATER (ug/l)	
Heptachlor	0.003	(1/5)	--	(0/5)	--	(0/4)	--	(0/3)
Parathion	0.004	(1/5)	0.6 - 3.9	(3/5)	0.08	(1/4)	--	0/3
Malathion	--	(0/5)	--	(0/5)	0.01	(1/4)	--	0/3
Dieldrin	--	(0/5)	--	(0/5)	--	(0/4)	0.04	1/3
Lindane	--	(0/5)	--	(0/5)	--	(0/4)	0.03	1/3
4,4'-DDT	0.04 - 120,000	(5/5)	0.17 - 13000	(5/5)	0.001 - 8.2	(3/4)	15	1/3
2,4'-DDT	0.36 - 38,000	(5/5)	0.06 - 3900	(5/5)	0.42, 1.9	(2/4)	4.4	1/3
DDD	0.43 - 28,000	(5/5)	140 - 3900	(4/5)	0.47, 2.5	(2/4)	8.5	1/3
DDE	0.04 - 4000	(5/5)	6.1 - 130	(3/5)	0.026, 0.058	(2/4)	0.15	1/3
2,4-D	0.002 - 0.13	(4/5)	0.42	(1/5)	0.022 - 0.37	(3/4)	0.1, 20	2/3
2,4,5-T	0.005 - 0.05	(4/5)	0.37, 0.61	(2/5)	0.006, 0.040	(2/4)	0.45	1/3

Sources: Dames and Moore, 1985 and 1986

due to the infiltration of water through the unsaturated zone. Pesticide residues, however, are strongly sorbed to the soil substrata, as shown by the relatively low concentrations measured in groundwater. The migration of pesticides in the subsurface appears to be limited. No pesticide residues were observed in any of the subsurface soils or groundwater samples tested during the 1987 program. The extent of groundwater migration from the pesticide pit has not been completely defined, however, since no sampling was performed in the groundwater in the bedrock aquifer. Only two wells (i.e., JSW-2 and JSW-3) were located at the top of the water table immediately downgradient of the pit.

Migration of DDT via surface drainage was demonstrated based on results of sediment and surface water samples JSD-100/JSW-001 at surface location 100. The extent of migration further along the drainageway has not been documented, nor have the concentrations in surface soils between the sample location and the pesticide pit. Eroded soil from the pit surface appears to be transported to the small ponded area, which may serve as a sediment trap.

11.0 PRELIMINARY IDENTIFICATION OF PUBLIC HEALTH RISKS

11.1 INTRODUCTION

The purpose of this section is to identify potential risks posed to public health and to determine further investigations (if any) warranted at the site. A complete public health risk assessment will be done at completion of the full remedial investigation. Chemical compounds identified in the various media at the Stewart ANGB disposal site are listed in Table 11-1. Potential toxicological effects of prolonged exposure to these chemicals are briefly summarized in Table 11-2. The following discussion reviews the data collected and compares the results to appropriate guidelines or standards, identifies and locates potential human receptors, and describes additional data required to complete a full risk assessment.

11.2 RESULTS AND COMPARISON TO REGULATIONS

11.2.1 Subsurface and Surface Soils. The majority of soil samples collected were from subsurface locations. The sediment/surface soils were taken from areas that collected runoff during periods of precipitation. During dry periods, these areas can be exposed; thus, the classification as surface soils. The only compounds considered potential contaminants in subsurface soils are BEHP and PCBs. In surface soils, pesticides and PAHs were also identified. There are no federal or state standards or criteria pertaining to chemicals in the soil.

TABLE 11-1

SUMMARY OF CONDITIONS AT
STEWART ANGB LANDFILL AREA

TECHNICAL FACTORS	SUBSURFACE SOILS	SEDIMENT/ SURFACE SOILS	SURFACE WATER	GROUNDWATER
Chemicals 1,1,1-tri- chloroethane	VOCs: Not above CRDL* Metals: Normal soil constituents SVOCs: BEHP, PCBs Pesticides: Not above CRDL	VOCs: Not above CRDL Metals: Normal soil constituents SVOCs: PAHs, BEHP Pesticides: 4,4-DDT 4,4-DDE 4,4-DDD	VOCs: Not above CRDL Metals: Al, Ca, Fe, Mg, Mn, Na SVOCs: Not above CRDL Pesticides: 4,4-DDT	VOCs: Blank Metals: Ca, Fe, Mg, Mn, Hg (suspect data at JMW-108), and Na SVOCs: BEHP Pesticides: Not above CRDL
Chemical Transport Mechanisms	Both BEHP and PCBs are relatively insoluble in water and are therefore fairly immobile in the soil environment.	Both pesticides and PAHs are relatively insoluble in water; thus, they will remain absorbed to soils. Can be transported via erosion and fugitive dust.	Standing surface water only occurs during periods of precipitation. Could be transported off-site via excessive runoff.	Groundwater flow is toward the adjacent wet area associated with Murphy's Gulch.

TABLE 11-1 (continued)

SUMMARY OF CONDITIONS AT
STEWART ANGB LANDFILL AREA

TECHNICAL FACTORS	SUBSURFACE SOILS	SEDIMENT/ SURFACE SOILS	SURFACE WATER	GROUNDWATER
Persistence of Chemicals	BEHP is ubiquitous in the environment and is not readily degraded. PCBs are stable in the environment. Higher chlorinated forms are resistant to bio- degradation.	PAHs are strongly absorbed to soil particles. They can undergo microbial inorganic degradation. DDT also is strongly absorbed to soil particles. It has an estimated half-life of 17 years. DDE is its breakdown product.	See Sediment/Surface Soils	Hg is the only metal of concern. Its persistence is determined by form. It can be tightly bound to soil particles. Inorganic Hg can be made more toxic via methy- lation by microorganisms.

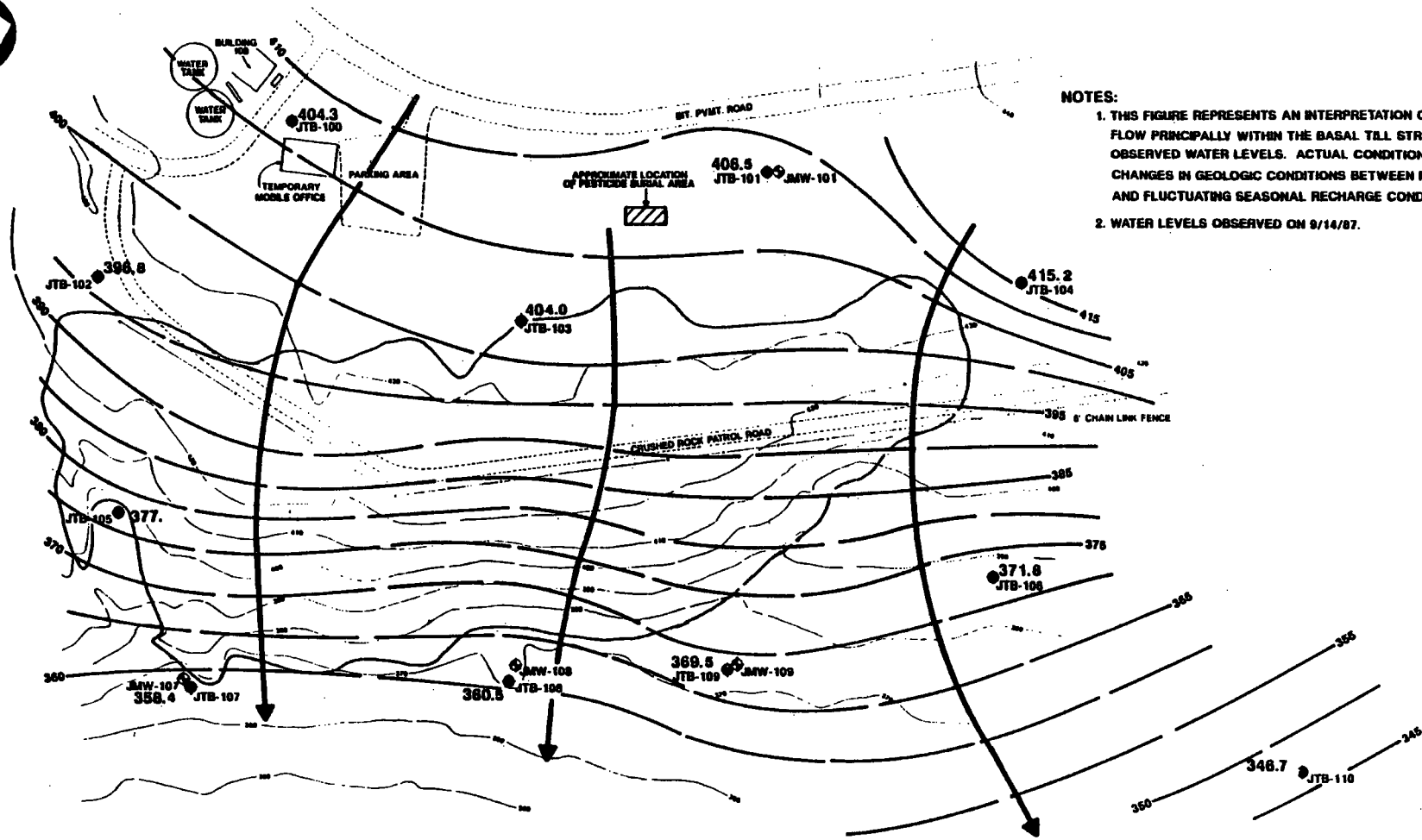
* CRDL: Contract Required Detection Limit

A water supply well recently drilled at Stewart ANGB reached a total depth of 1,100 feet in shale and yielded less than 10 gallons per minute (gpm) (Morano Construction, personnel communication). Yields for wells in shale in Orange County range from 0 to 400 gpm, averaging 22 gpm (Hammond, 1978). The high yields are probably associated with fault zones and other highly fractured bedrock areas. Data for wells tapping sandstone in Orange County indicate that well yields range from 4 to 50 gpm, with an average of 22 gpm.

7.4.2 Local Hydrogeology

Groundwater at the site occurs in the unconsolidated ablation till and basal till, and in the underlying bedrock. Groundwater saturates the ablation till only near the toe of the landfill. The ablation till in the more upland areas of the site is unsaturated.

Based on groundwater level data for October 19, 1987, groundwater flow in the basal till (from "B"-series piezometers) and the bedrock (from "A"-series piezometers) is southeast toward the toe of the former landfill. Interpretative potentiometric surface contour maps for the basal till and the bedrock are shown in Figures 7-1 and 7-2. The potentiometric surfaces for both conform to the bedrock topography shown in Figure 7-3. Because only two boring locations have monitoring points in the ablation till, accurate determination of groundwater flow direction in the ablation till was not possible. Using a horizontal hydraulic gradient of 0.007 (measured between JTB-101B and JTB-108B on



NOTES:

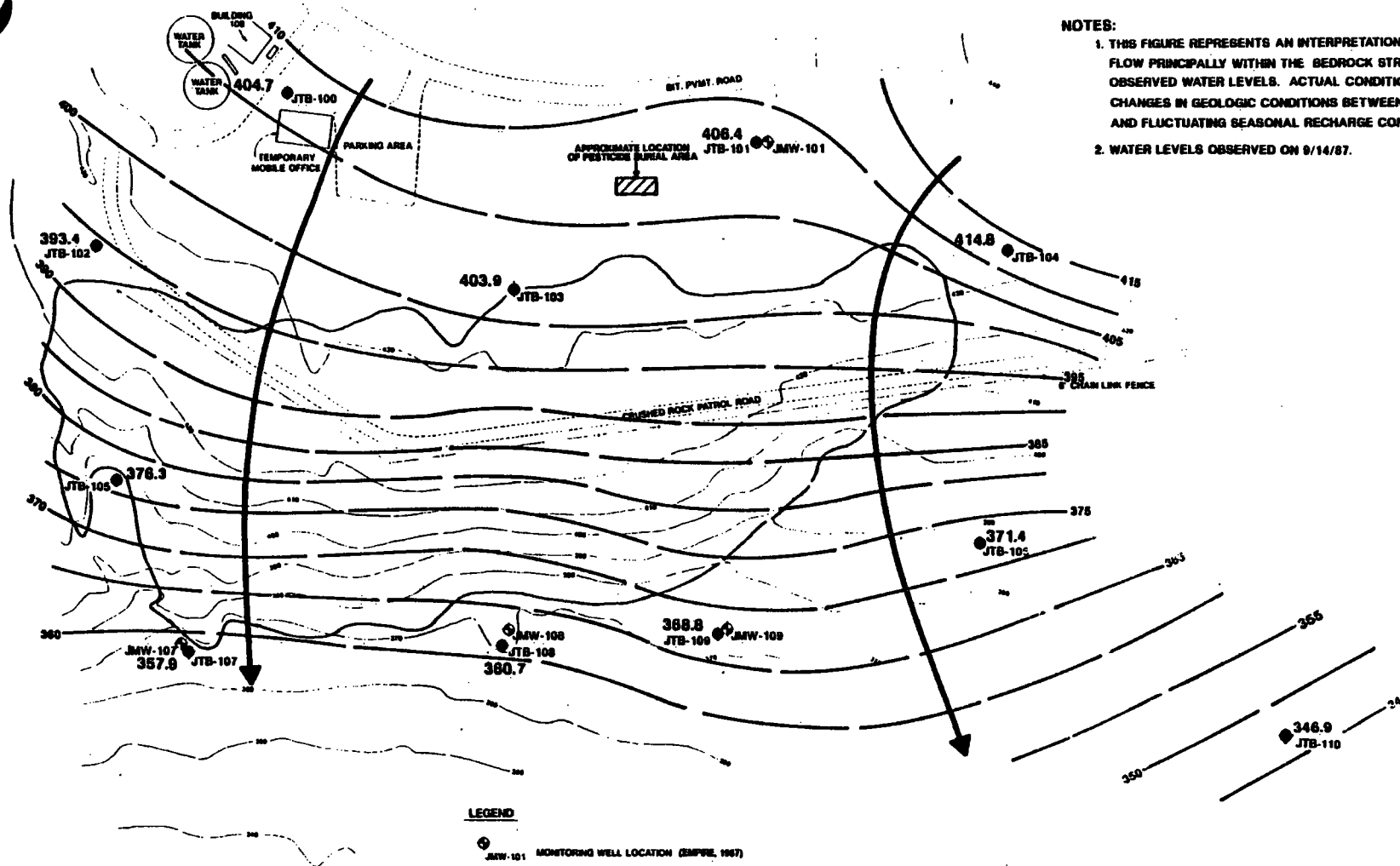
1. THIS FIGURE REPRESENTS AN INTERPRETATION OF THE GROUNDWATER FLOW PRINCIPALLY WITHIN THE BASAL TILL STRATUM ON THE DATE OF OBSERVED WATER LEVELS. ACTUAL CONDITIONS MAY VARY DUE TO CHANGES IN GEOLOGIC CONDITIONS BETWEEN MONITORING LOCATIONS, AND FLUCTUATING SEASONAL RECHARGE CONDITIONS.
2. WATER LEVELS OBSERVED ON 9/14/87.

LEGEND

- MW-101 MONITORING WELL LOCATION (EMPIRE, 1987)
- JTB-101 TEST BORING AND PIEZOMETER LOCATION (EMPIRE, 1987)
- 360.5 OBSERVED WATER LEVELS ON 9/14/87 (FT. MSL.)
- 350 INTERPRETIVE POTENTIOMETRIC SURFACE CONTOUR (FT. MSL.)
- BOUNDARY OF FORMER LANDFILL (MAGNETOMETER SURVEY)
- BOUNDARY OF FORMER LANDFILL (INFERRED)
- ← INTERPRETIVE GROUNDWATER FLOW DIRECTION



ECJORDANCO <small>ENGINEERING CONSULTANTS</small>	POTENTIOMETRIC SURFACE BASAL TILL "B" LEVEL PIEZOMETERS	
INSTALLATION RESTORATION PROGRAM STEWART AIR NATIONAL GUARD BASE N.Y.	TASK 2A(1)	FIGURE 7-1



NOTES:

1. THIS FIGURE REPRESENTS AN INTERPRETATION OF THE GROUNDWATER FLOW PRINCIPALLY WITHIN THE BEDROCK STRATUM ON THE DATE OF OBSERVED WATER LEVELS. ACTUAL CONDITIONS MAY VARY DUE TO CHANGES IN GEOLOGIC CONDITIONS BETWEEN MONITORING LOCATIONS, AND FLUCTUATING SEASONAL RECHARGE CONDITIONS.

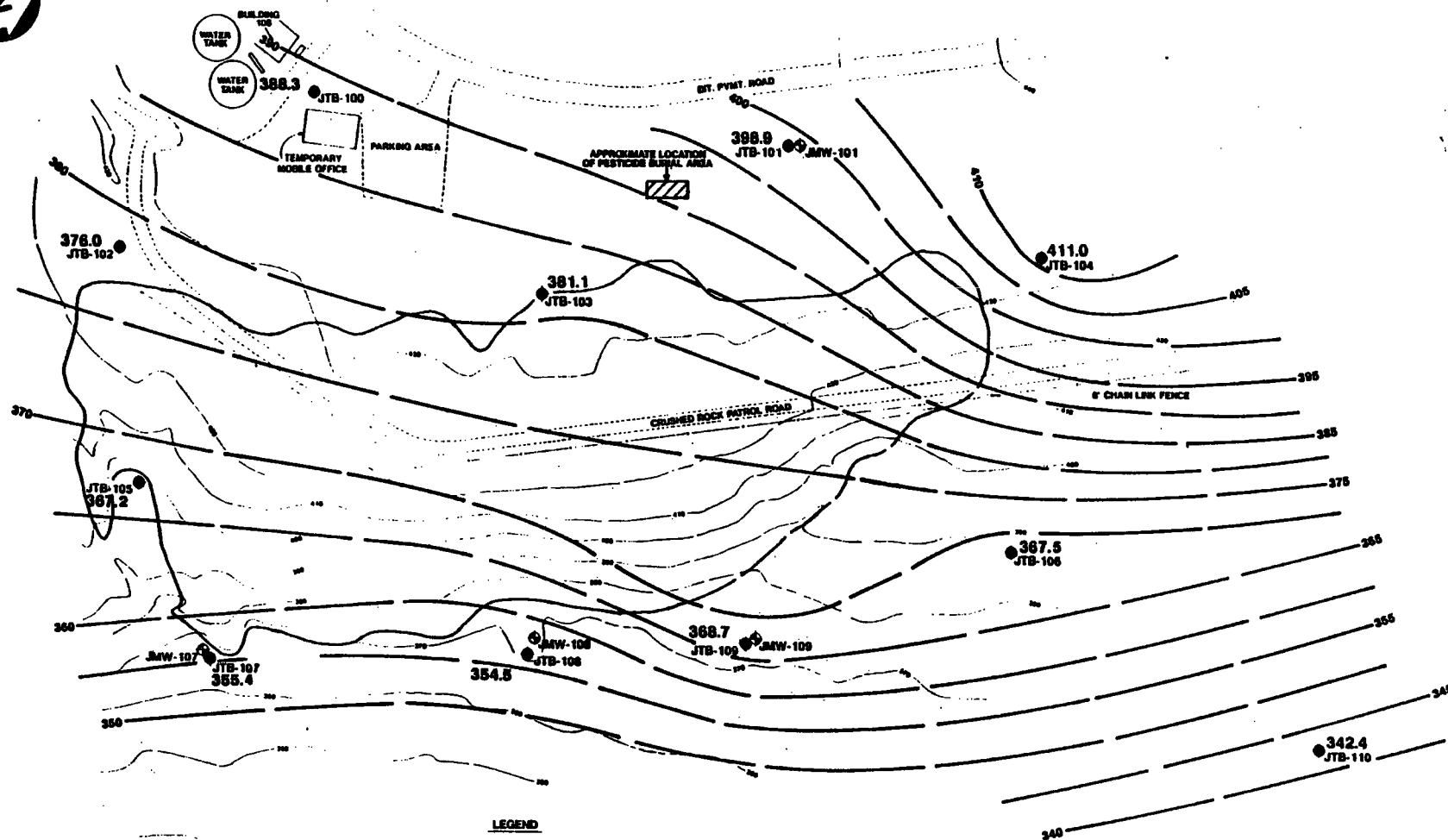
2. WATER LEVELS OBSERVED ON 9/14/87.

LEGEND

- JMW-101 MONITORING WELL LOCATION (EMPR, 1987)
- JTB-101 TEST BORING AND PIEZOMETER LOCATION (EMPR, 1987)
- 346.9 OBSERVED WATER LEVELS ON 9/14/87 (FT. MSL)
- 350 INTERPRETIVE POTENTIOMETRIC SURFACE CONTOUR (FT. MSL)
- BOUNDARY OF FORMER LANDFILL (MAGNETOMETER SURVEY)
- BOUNDARY OF FORMER LANDFILL (INFERRED)
- ← INTERPRETIVE GROUNDWATER FLOW DIRECTION



EQUORDANCO <small>INCORPORATED</small>	POTENTIOMETRIC SURFACE BEDROCK "A" LEVEL PIEZOMETERS	
<small>INSTALLATION RECLAMATION PROGRAM STEWART AND NATIONAL GUARD BASE, NY</small>	TASK 2A(1)	FIGURE 7-2



LEGEND

- MW-101 MONITORING WELL LOCATION (EMFPI, 1987)
- JTB-101 TEST BORING AND PNEUMETER LOCATION (EMFPI, 1987)
- 354.5 BEDROCK SURFACE ELEVATION (FT., MSL)
- - - - - INTERPRETIVE TOP OF BEDROCK SURFACE CONTOUR (FT., MSL)
- - - - - BOUNDARY OF FORMER LANDFILL (MAGNETOMETER SURVEY)
- - - - - BOUNDARY OF FORMER LANDFILL (INFERRED)

NOTES:

1. BEDROCK SURFACE CONTOURS BASED ON INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATION DATA. ACTUAL CONDITIONS MAY VARY FROM THOSE SHOWN.



ECJORDANCO <small>Environmental Consulting & Remediation</small>		BEDROCK SURFACE CONTOUR MAP	
INSTALLATION RESTORATION PROGRAM STEWART AIR NATIONAL GUARD BASE, NY		TASK 2A(1)	FIGURE 7-3

September 14, 1987), an average horizontal hydraulic conductivity of 4.2×10^{-5} cm/sec, and an effective porosity of 0.20, the average groundwater velocity for the till is approximately 1.52 ft/yr (1.47×10^{-6} cm/sec).

Vertical downward hydraulic gradients (recharging condition) were measured at all locations except JTB-108 and JTB-110 (September 14, 1987, water levels). Downward gradients between the till and bedrock ranged from 0.005 to 0.239 ft/ft and downward gradients in the till ranged from 0.515 to 0.878 ft/ft. Although permeability data are not available for the bedrock, these data suggest that the upper portions of the bedrock are less permeable than the till. The upward gradients measured between the till and the bedrock at JTB-108 and JTB-110 range between 0.01 and 0.03.

In general, the site serves as a groundwater recharge area. Groundwater in the till discharges under unconfined conditions into Murphy's Gulch, which runs northward along the western side of the thruway. A small component of the flow in the lower portion of the on-site till may flow beneath Murphy's Gulch and discharge to Lake Washington to the east. Over the northern portions of the site, shallow groundwater in the till moves downward and recharges the bedrock. South of the toe of the former landfill, groundwater in the bedrock moves upward and discharges into the basal till.

Although no water level data are available for the area directly underlying the landfill, the understanding of site hydrogeology suggests that the glacial till extends beneath the landfill and that groundwater may be moving vertically from the till into the bedrock. Consequently, potential exists for landfill

leachate to migrate into the bedrock. Farther downgradient, groundwater in the bedrock flows upward into the glacial till and discharges into Murphy's Gulch.

7.5 GROUNDWATER USE CLASSIFICATION

Most of the water supply in the region is obtained from surface water reservoirs. While the glacial till is not a high-yield deposit, nor used extensively in the immediate area as a water resource, the groundwater is classified as Class GA. According to NYSDEC's Groundwater Classifications Quality Standards and Effluent Standards and/or Limitations, Section 703.5, the best usage of Class GA waters is as a source of potable water.

7.6 GROUNDWATER SAMPLING

Groundwater sampling consisted of one round. On September 1 and 2, 1987, JMW-101 and JMW-107 through JMW-109 were sampled according to provisions in the QAPP. Groundwater samples were shipped to CompuChem Laboratories according to USEPA's CLP procedures. Analytical results are tabulated in Appendix E, and Surface and Groundwater Field Sample Data Records are included in Appendix F.

TABLE 11-2

TOXICOLOGICAL PROPERTIES OF COMPOUNDS IDENTIFIED IN
VARIOUS MEDIA AT STEWART AIR NATIONAL GUARD BASE LANDFILL AREA

COMPOUND CLASS	MEDIA IDENTIFIED IN	SPECIFIC COMPOUNDS	TOXICOLOGICAL PROPERTIES ¹
<u>Semivolatile Compounds</u>			
Phthalate esters	Subsurface soils	Bis(2-ethylhexyl)phthalate	BEHP is considered a probable human carcinogen. It has low acute toxicity. Very high doses are potentially teratogenic and embryotoxic.
PCBs	Subsurface soils	Arochlor-1254	PCBs are considered a probable human carcinogen. Arochlors can bioaccumulate in humans. Can be fetotoxic. Can be absorbed through all routes.
PAHs	Sediment/surface soils	Phenanthrene, fluoranthene, pyrene benzo(a)anthracene, benzo(b(k)fluoranthene benzo(a)pyrene	PAHs are a diverse group of compounds of varying toxicity. They are highly lipid-soluble and are absorbed through the GI and respiratory tracts, and to a lesser degree, through the skin. Many PAHs have been shown to be potentially carcinogenic. Other PAHs are thought to be noncarcinogenic; these include fluorine, anthracene, pyrene, naphthalene, phenanthrene, and fluoranthene. The acute toxicity and chronic toxicity of low-level exposure are not well-understood.
Pesticides	Subsurface soils sediment/surface soils	4,4-DDT 4,4-DDD	DDT is considered a probable human carcinogen. DDT bioaccumulates in the food chain. In humans it is stored in the fatty tissues.

TABLE 11-2 (continued)

TOXICOLOGICAL PROPERTIES OF COMPOUNDS IDENTIFIED IN
VARIOUS MEDIA AT STEWART AIR NATIONAL GUARD BASE LANDFILL AREA

COMPOUND CLASS	MEDIA IDENTIFIED IN	SPECIFIC COMPOUNDS	TOXICOLOGICAL PROPERTIES ¹
<u>Inorganic Compounds</u>			
Metals	Groundwater	Hg	Toxicological effect depends on chemical form: elemental organic or inorganic, with the organic form most toxic. The direct effect is on the central nervous system. USEPA DWEL for Hg is 5.5 µg/l.
Volatile Organic Compounds	Groundwater	Vinyl chloride	Known carcinogen
		trans-1,2-dichloroethene	USEPA DWEL is 70 µg/l
		1,1,1-trichloroethane	USEPA DWEL is 200 µg/l
		acetone, chloroform	Low toxicity
		1,1-dichloroethane chloromethane bromomethane	Information currently not available.
		chloroethane	

¹ In assessing the risks to human health and the environment posed by these chemicals, not only toxicological properties but also potential receptors and probable exposure conditions must be considered. These factors will be addressed in the full risk assessment, which will be part of the complete RI.

The following discussion qualitatively evaluates the significance of the findings of the site investigation.

PCBs. PCBs were identified at two subsurface locations (at depths of 12 and 31 feet), one upgradient of the defined disposal area (210 ug/kg at JMW-101) and one downgradient of the southern edge (210 ug/kg at JTB-102). The source of these compounds is not clear. In saturated subsurface soils, PCBs tend to remain absorbed to soils. It is hypothesized that these data represent separate areas of contamination and are not evidence of migration. Potential health effects of PCB exposure include evidence of carcinogenicity and fetotoxicity. (For a complete discussion, see Toxicological Profile Report on Selected PCBs, USEPA, 1987.)

BEHP. BEHP is ubiquitous in the environment and is classified as a probable human carcinogen by USEPA; however, it is not highly potent. The maximum level present in Stewart ANGB soils was 1,100 ppb, found at a depth of 31 feet. This level is not considered to pose a public health risk, given its subsurface location. BEHP was detected in the sediment/surface soil sample at 66 ug/kg (estimated concentration). Further surface soil sampling is required to determine if this source presents a public health risk.

PAHs. A variety of PAHs were identified in the sediment/soil sample. The compounds above the CRDL were fluoranthene, phenanthrene, pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene. Benzo(a)anthracene and benzo(a)pyrene were present at concentrations just below the CRDL. These compounds, not identified in the subsurface soils, tend to remain absorbed to soils; therefore, they have

low mobility in groundwater, but can be distributed by fugitive dust. Further soil sampling is required to determine the distribution of these compounds and to assess the potential public health risk.

PAHs are compounds of varying toxicity. Many PAHs have been shown to have carcinogenic potential, while others do not exhibit carcinogenicity (see Table 11-2). Of the PAHs identified at this site, NYSDEC classified the following as carcinogenic: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene (NYSDEC, 1985).

DDT. 4,4-DDT, and its breakdown products, 4,4-DDE and 4,4-DDD, were identified in the sediment/surface soils at runoff collection location JSD-100 at levels of 3,100; 230, and 130 ug/kg, respectively. It is hypothesized that the source is from previous subsurface exploration activities associated with the pesticide burial investigation on-site, which left contaminated soil on the surface. Without further surface soil samples, it is not possible to estimate the extent of contamination or potential impact on on- and off-site receptors. 4,4-DDT is persistent in the environment and bioaccumulates in the food chain, and is classified by USEPA as a probable human carcinogen. Thus, it may be of concern due to chronic, but not acute, exposure.

Under present site conditions and in the absence of excavations, PCBs and BEHP, identified in the subsurface soils (at least 5 feet below the surface), pose little risk of human contact or ingestion. PAHs and 4,4-DDT were both identified in surface soils; therefore, human exposure to these compounds is possi-

ble. Further surface soil data are required to estimate the magnitude of this risk.

Soils containing these compounds may be uncovered and exposed during future excavations, especially since pesticide waste removal is planned. Such excavations would present chemical exposure risks to excavators, site workers, and passersby. The possible exposure routes for chemicals in the soil during excavations include direct contact and inhalation. Risks due to this type of exposure will be evaluated in the full investigation report. As appropriate, recommendations will be made to minimize exposure during periods of excavation.

11.2.2 Groundwater and Surface Water

Currently, it is understood that this aquifer is used as a potable source approximately 1,200 to 1,800 feet downgradient of the disposal site. However, most public supplies are taken from the nearby reservoirs. At this time, exposure to contaminants of concern through groundwater is minimal because of: (1) the low levels of contaminants found at on-site wells, and (2) the distance between private wells and the site.

Analysis of groundwater samples showed no pesticides, one SVOC, one VOC, and a variety of inorganic constituents. The only VOC identified above the CRDL was 1,1,1-trichloroethane at 8.6 ug/l. This concentration, several orders of magnitude below USEPA's Drinking Water Equivalent Level (DWEL) of 1,000 ug/l, is not considered to pose a risk to public health.

The only SVOC identified was BEHP, at levels ranging from 2.4 to 26 ug/l. USEPA classified it as a B2; that is, a (probable) human carcinogen.

Several inorganic compounds were identified in the groundwater, most of which are normal constituents. The possible contaminant of concern in these data is mercury, which was identified only at JMW-108. This data point may be an anomaly, as it was reported in only one of four samples from this well. However, at the reported concentration of 7.5 ug/l, this exceeds the USEPA DWEL of 5.5 ug/l, which is a USEPA guideline for lifetime consumption.

4,4-DDT was identified in the surface water. Because human exposure to this intermittent standing surface water is minimal, it is not considered to pose a public risk; however, it may indicate a transport pathway of contaminants off-site.

11.2.3 Summary

In summary, based on this initial site investigation, it appears that there has not been substantial migration of compounds from the disposal area. The compounds identified are generally immobile in a soil matrix. The toxicity of these compounds is of concern for chronic, as opposed to acute, exposures. Information is lacking on the extent of possible surface soil contamination. Levels of some contaminants (especially mercury) in the groundwater need verification.

11.3 PRELIMINARY EXPOSURE ASSESSMENT

Based on the site investigation, it is expected that human contact with the on-site soils would be minimal because of topography and location factors. The disposal area is on the side of a fairly steep embankment, dropping approximately 100 feet over a distance of 600 feet. The proximity of the thruway, approximately 600 feet from the edge of the disposal area, also limits access by unauthorized persons. However, the site is only partially fenced and deer tracks were noted by the field team. Thus, occasional access by people (e.g., hunters) is possible. Given the location, it is not expected that children would frequent the area. An access road, installed by the ANGB, could expose base personnel to soil contaminants during maintenance activities; however, other than major road construction, this is not expected to be a significant route of exposure.

The on-site surface water, as discussed previously, is from surface runoff. The intermittent nature of its occurrence indicates that it is not a significant route of exposure.

To conservatively estimate risks to groundwater, it is assumed that an individual would drink 2 liters/day for an entire lifetime (i.e., 70 years) from the on-site wells. The maximum reported concentrations are used to approximate a worst-case scenario. For BEHP, the only carcinogen, the maximum excess risk is 5×10^{-7} .

Generally, risks of 10^{-4} to 10^{-7} are considered within the CERCLA guidelines for cleanup of hazardous waste sites. This indicates that vinyl chloride may pose a risk; however, this is highly uncertain, given its infrequent occurrence. The only non-carcinogenic risk estimated was for Hg. A ratio of the body dose calculated from these data to a body dose based on the DWEL indicates a risk ratio of 1.4. A ratio less than 1 indicates a low risk, while a ratio greater than 1 indicates health risks may be present.

Because municipal water is provided to base personnel and most area residents, Jordan believes that groundwater is not expected to present a specific public health risk. However, because there are some downgradient wells, further groundwater sampling is required to support the assumption of no contamination.

11.4 ADDITIONAL DATA NEEDS

To conduct a full public health risk assessment for the disposal area at the Stewart ANGB, the following additional information is needed:

- o levels of contaminants in surface soils to determine if risks are posed to humans through direct contact
- o levels of contaminants in subsurface soils adjacent to the pesticide disposal area to determine if significant exposures may occur during excavation activities

- o additional groundwater samples to verify the presence or absence of mercury and to confirm the lack of SVOCs and pesticides

This additional information will make it possible to quantitate the public health risk at this site.

12.0 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

12.1 INTRODUCTION

The main purpose of performing a baseline environmental risk assessment at the Stewart ANGB disposal site is to assess present and potential future impacts on aquatic and terrestrial ecosystems which may be affected by site contaminants. Such an assessment will provide sufficient information to identify remedial response objectives, develop and evaluate remedial alternatives, and develop mitigative measures to protect the natural environment. The following discussion includes a review of existing analytical data, a preliminary environmental exposure assessment, an assessment of data necessary to complete an environmental risk assessment at the site, and the anticipated outline of the environmental risk assessment.

12.2 REVIEW OF CURRENT DATA

Available data that may be used to perform environmental risk assessment at the Stewart ANGB disposal site include sample analyses for three surficial sampling locations. Surface water and sediment samples were collected at Station JSD-100; sediment samples were collected only at Stations JSD-101 and JSD-102. Sampling of JSW-1, JSW-2, and JSW-3 was performed by Dames and Moore during a previous investigation. Analytical data from subsurface soil samples collected at the site cannot be used for environmental risk assessment, because there are

no exposure pathways for subsurface media. Organic and inorganic analytical data from surface water and sediments are summarized in Tables 12-1 and 12-2; groundwater data are summarized in narrative form.

Analytical results for the three sediment samples show markedly different organic chemical profiles. Analysis of sample JSD-100 revealed the presence of 4,4'-DDT (3,100 ppb), 4,4'-DDD (170 ppb), and 4,4'-DDE (230 ppb) in sediment. Pesticides were not reported at Stations JSD-101 and JSD-102. However, sediment sample JSD-101 was found to contain several PAHs. No chemicals were detected above CRDL in sediment sample JSD-102, except acetone and methylene chloride, which were also detected in blanks. No organophosphorus pesticides (i.e., sulfotepp, phorate, dimethoate, disulfoton, methyl parathion, and parathion) or chlorinated herbicides (i.e., 2,4-D, 2,4,5-TP, and 2,4,5-T) were detected in any sediment sample.

The only organic chemical reported at surface water sampling Station 100 (sample JSW-001) was 4,4'-DDT (0.57 ug/l). The value reported for 4,4'-DDT is substantially above the chronic Ambient Water Quality Criteria (AWQC) for DDT of 0.001 ug/l. Because this sample was not filtered and surface water was observed to be turbid at the time of sampling, it is possible that this value may be due, in part, to adsorbed suspended particulates present in the sample rather than in solution. However, this value is below the aqueous solubility of 4,4'-DDT (5.5 ug/l).

These data indicate that pesticides and SVOCs are potentially widespread organic contaminants at the site, but provide no information on the areal

TABLE 12-1

SUMMARY OF ORGANIC ANALYTICAL DATA
FOR SURFACE WATER AND SEDIMENTS

CONSTITUENT	CONCENTRATION			
	SD-100 (ug/kg)	SW-001 (ug/l)	SD-101 (ug/kg)	SD-102 (ug/kg)
<u>Volatile Organics</u>	--	--	--	--
<u>Semivolatile Organics</u>				
Phenanthrene	--	--	500	--
Fluoranthene	--	--	620	--
Pyrene	--	--	540	--
Benzo(b)fluoranthene	--	--	450	--
Benzo(k)fluoranthene	--	--	450	--
Benzo(a)pyrene	--	--	260	--
<u>Pesticides/PCBs</u>				
4,4'-DDE	--	--	--	230
4,4'-DDD	170	--	--	--
4,4'-DDT	3100 C	0.57	--	--
<u>Organophosphorus Pesticides</u>	--	--	--	--
<u>Chlorinated Herbicides</u>	--	--	--	--

-- = Analyzed for but not detected.

C = Confirmed by mass spectrometry.

Note: Highest value reported at each sampling location listed.

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0011.0.0

TABLE 12-2

SUMMARY OF INORGANIC ANALYTICAL DATA
FOR SURFACE WATER AND SEDIMENTS

CONSTITUENT	CONCENTRATION			
	SD-100 (mg/kg)	SW-001 (ug/l)	SD-101 (mg/kg)	SD-102 (mg/kg)
Arsenic	4.4 SN	--	3 N	--
Cadmium	3.7	--	--	2.9
Chromium	21	--	11	8.7
Copper	44	--	--	--
Lead	28 N	--	24 N	29 N
Mercury	--	--	--	0.26 N
Nickel	21	--	15	--
Zinc	104	--	59	43
Barium	86	--	--	--
Iron	32600	1460	15900	9650
Manganese	1190	87	2310	282
Vanadium	22	--	15	--
Aluminum	15600	739	7370	6400
Magnesium	6520 E	34800	2880 E	1990 E
Calcium	9060	13500	3430	3980
Sodium	--	18900	--	--

-- = Analyzed for but not detected.

N = Indicates spike sample recovery is not within control limits.

E = Indicates a value estimated due to interference.

Note: Highest value reported at each sampling location listed.

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extent. Additionally, because PCBs were reported at depth in soils, they are also a potential surficial contaminant. It should be noted that surface water or sediment sampling was limited in areas topographically downgradient of the site.

Based on available data, inorganic sediment contamination appears limited at the site. Levels of inorganic constituents appear slightly higher in sediment sample JSD-100 than in JSD-101 and JSD-102, overall. However, the reported levels appear to be within concentration ranges typically occurring naturally in soils, as described in Section 6.5.1. Inorganic contamination of surface water at the one location sampled also does not appear to be significant. The concentration of iron in the surface water sample (JSW-001) collected at Station 100 exceeds the AWQC of 1 ppm; however, the USEPA criteria document acknowledges that iron is often found in marsh water at concentrations greater than 1 ppm, with no adverse effects on aquatic life. Marshy conditions exist in the ponded area at Station 100, due to the presence of emergent vegetation. Levels of other inorganic constituents in the surface water sample collected do not appear elevated.

As described in Section 7.7, levels of cations were higher in JMW-101 than in other wells, except for mercury, which was detected at 7.4 ug/l in JMW-108. Low levels of VOCs are believed to be migrating from the landfill. Additionally, sampling of JSW-1, JSW-2, and JSW-3 (located adjacent to the pesticide burial pit) by Dames and Moore revealed the presence of pesticides in groundwater at depths ranging from about 35 to 50 feet; JSW-2 contained the highest levels of contamination. Data from the Dames and Moore wells indicate that

pesticides have migrated vertically downward and horizontally away from the disposal area toward the east and southeast. Therefore, it appears possible that contaminated groundwater may discharge to the surface at downgradient locations.

12.3 ENVIRONMENTAL EXPOSURE ASSESSMENT

Numerous species of birds, mammals, amphibians, reptiles, and invertebrates are expected (but have not yet been documented) in the vicinity of the Stewart ANGB disposal site. These organisms may be exposed to hazardous constituents as a result of direct contact with contaminated soils, sediments, and surface water; drinking-contaminated surface water; ingestion of other contaminated organisms; and inhalation of contaminants adsorbed to airborne particulates.

Based on available data, it appears that exposure to pesticides, SVOCs, and possibly PCBs may be occurring. However, it is impossible to evaluate the significance of these exposures at this time because: (1) the areal extent of contamination is not known, and (2) the species and numbers of organisms potentially exposed have not been documented. Additionally, the wet area east and southeast of the site is a potential receptor of contamination via surface runoff or groundwater discharge. Migration of DDT via surface drainage has been demonstrated based on analytical results for samples JSD-100 and JSW-001 collected in a small ponded area receiving runoff from the pesticide burial pit. The potential for discharge of contaminated groundwater to the wetland also exists, although the levels of contaminants detected in wells between the

former landfill and the wetland (JMW-107, JMW-108, and JMW-109) do not appear to pose a hazard to aquatic organisms, except for mercury in JMW-108. If contaminants are present in wetland sediments and surface water, exposures to aquatic organisms may also be occurring.

12.4 DATA GAPS AND RECOMMENDATIONS

Environmental risk assessment cannot be performed at this time for two reasons. First, the extent of chemical contamination in soils, sediments, and surface water is not known, precluding estimates of the potential magnitude of exposure. Second, organisms that may be exposed to contaminants in environmental media have not yet been identified. The approach developed to address these environmental risk assessment data needs is described in the following paragraphs.

To evaluate risks to terrestrial ecosystems, soil/sediment samples would be collected topographically upgradient of the pesticide burial area (background), along identifiable drainage swales, and between the former landfill and the wetland, to determine the areal extent of contamination. If earthworms are found near potentially contaminated areas, they would also be sampled and analyzed to evaluate the potential for food chain exposures. (Earthworms are primary consumers and serve as prey for other terrestrial organisms.) Also, a terrestrial habitat assessment will be performed at the site, and telephone interviews will be conducted with state fisheries and wildlife officials, to identify terrestrial organisms that may be exposed to surficial contamination.

To evaluate risks to aquatic ecosystems, wetland surface water and sediment sampling would be performed, and biological sampling would be conducted to identify aquatic organisms potentially exposed to contaminants in the wetland. Based on results of worm sampling and wetland surface water and sediment sampling, additional analyses of biota tissue samples may be necessary to address the extent of food chain contamination. This approach will provide sufficient information to develop and screen remedial alternatives in a timely and cost-effective manner.

12.5 OUTLINE FOR BASELINE ENVIRONMENTAL RISK ASSESSMENT

The anticipated organization of the environmental risk assessment for the Stewart ANGB disposal site is presented in the following outline.

- 1.0 Baseline Environmental Risk Assessment
 - 1.1 Introduction
 - 1.2 Biological Characterization
 - 1.2.1 Aquatic Flora and Fauna
 - 1.2.2 Terrestrial Flora and Fauna
 - 1.3 Wetland Functional Attributes
 - 1.4 Floodplains Assessment
 - 1.5 Impact Evaluation
 - 1.5.1 Summary of Analytical Data
 - 1.5.2 Summary of Contaminant Transport and Fate
 - 1.5.3 Environmental Exposure Analysis
 - 1.5.4 Environmental Risk Characterization
 - 1.5.5 Observed Effects
 - 1.5.6 Summary of Current and Future Impacts
 - 1.6 Summary and Conclusions

A floodplain assessment is included in the outline, because it is assumed that the wetland at the site lies within the 100-year floodplain. Federal agencies

are mandated to evaluate floodplain impacts by the Floodplains Management Executive Order (E.O. 11988).

13.0 SUMMARY/CONCLUSIONS AND RECOMMENDATIONS

Based on results of the Initial Site Investigation, Task 2A(1) of the Phase II/IVA activities at the former landfill and the adjacent pesticide burial site at the Stewart ANGB in Newburgh, New York, a set of conclusions have been drawn and recommendations for further action have been developed. These conclusions and recommendations are summarized in the following sections.

13.1 SUMMARY/CONCLUSIONS

13.1.1 Hydrogeology

In general, the site serves as a recharge area. Groundwater in the till discharges under confined conditions into Murphy's Gulch. A small component of flow in the lower portion of the on-site till may flow beneath Murphy's Gulch and discharge to Lake Washington. The site hydrogeology suggests that the glacial till extends beneath the landfill and that groundwater may be moving vertically from the till into the bedrock. Consequently, potential exists for landfill leachate to migrate into the bedrock. Farther downgradient, groundwater in the bedrock may flow upward into the glacial till and discharge into Murphy's Gulch.

13.1.2 Soils Contamination

The most serious soil contamination at the site appears to be related to migration of the chlorinated pesticide residues 2,4' DDT, 4,4' DDT, 4,4' DDD, and 4,4' DDE from the pesticide disposal pit. These residues were found to have migrated deep into the subsurface soils in the vicinity of the pit. Concentrations were measured by Dames and Moore (1985 and 1986) at low mg/kg levels in the soils 25 to 35 feet below the land surface. Groundwater adjacent to the pit was found to contain ug/l levels of pesticide residues. In addition to migration into the subsurface, DDT, DDD, and DDE were identified in the surface soil/sediment of a shallow ponded area downgradient of the landfill and pesticide pit. 4,4'-DDT was the predominant compound at this location and occurred at a concentration of approximately 3 mg/kg (3,000 ug/kg). The extent of contamination of surface soils, as a result of migration of pesticides from the pit area by surface water transport, is unknown.

PAHs were observed at low levels in a second surface soil/sediment location. Five compounds were identified at levels below the CRDL: acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, and chrysene. Five other PAH compounds were observed at concentration levels ranging from 450 to 620 ug/kg: benzo(b)fluoranthene, benzo(k)fluoranthene, fluoranthene, phenanthrene, and pyrene. The extent of distribution of these compounds in the site soil cannot be estimated based on existing data. PAHs have widespread distribution at levels in the low mg/kg range, due to their formation and emission from incomplete combustion of hydrocarbon fuels and wildfires. PAHs are also major

constituents of contamination resulting from disposal of coke-manufacturing waste, creosote, ash, and coal tar.

Two subsurface soil samples contained PCBs, each at 210 µg/kg. The PCB Araclor 1254 was identified at levels just above the CRDL. Because samples were not taken from borings into apparent fill materials and were located in areas topographically upgradient of the landfill at depths of 12 to 31 feet below the land surface, the extent of contamination and maximum PCB concentrations at the site cannot be estimated, based on existing data.

Low levels of the metals arsenic, cadmium, lead, mercury, and zinc were observed in subsurface soils and surface soil/sediments. No concentration patterns were apparent that would suggest the metals were related to contaminant migration from the landfill or the pesticide pit. In addition, none of the metals were found in concentrations higher than would be expected for uncontaminated soils.

Subsurface soils contained the VOCs, chloroform, and toluene, but at levels below the CRDL. Benzene, methylene chloride, and acetone were identified in environmental samples, also at levels below the CRDL. Because the method blanks contained these three chemicals at levels similar to the environmental samples, they are considered to be contaminants introduced during sample handling/analysis, and not present in the subsurface soils. The semivolatile phthalate esters (diethyl phthalate, BEHP, and di-n-butyl phthalate) were identified in subsurface and surface soil samples, at levels below the CRDL. These chemicals were detected in laboratory method blanks, as well as field

blanks; therefore, these chemicals were possibly not representative of site-related soil contamination. Phthalate esters, however, commonly occur in landfill leachate.

13.1.3 Groundwater Contamination

As indicated in the previous paragraph, chlorinated pesticide residues, two chlorinated phenoxy-herbicide residues, and two organic phosphate compounds were detected in groundwater in the immediate vicinity of the pesticide pit. Concentrations of DDT and its transformation products, DDE and DDD, ranging from 0.15 to 15 $\mu\text{g}/\text{l}$, were found at that location. The herbicide 2,4-D was observed at 20 $\mu\text{g}/\text{l}$; the remaining residues were less than 1 $\mu\text{g}/\text{l}$. Although pesticides were not observed in the groundwater farther downgradient at the toe of the landfill, the extent of migration in the groundwater in the vicinity of the pesticide pit is unknown.

Except for 1,1,1-trichloroethane, found at 8.6 $\mu\text{g}/\text{l}$ in JMW-107, all other compounds identified were below the CRDL. Methylene chloride was observed at similar levels in environmental samples, sampling/trip blanks, and in laboratory method blanks, and was judged to be an artifact rather than a site-related contaminant. Nine other HSL VOCs were identified in groundwater: acetone, 1,1,1-trichloroethane, 1,1-dichloroethane, trans-1,2-dichloroethene, chloroform, chloromethane, bromomethane, chloroethane, and vinyl chloride.

The distribution of these compounds in the wells and the comparability of the replicate samples suggest that the chemicals identified potentially represent

either: (1) migration of a more concentrated plume at greater depths in the aquifer, (2) the residual contamination from a plume or slug of VOCs that has migrated farther downgradient, (3) the beginning of a plume just beginning to migrate from the landfill, or (4) migration only of extremely low levels of VOCs. Therefore, the extent and concentration of contaminants in the source and migration in the groundwater are unknown. Because of the low levels observed, GC methods are likely to be more appropriate than GC/MS for further investigation of the upper portions of the aquifer.

The phthalate ester BEHP was observed in JMW-108, downgradient of the landfill. This compound is a common artifact of sample handling and was observed in the sampler blanks, but was not found in the associated laboratory method blanks. Phthalate esters are commonly observed in landfill leachate; therefore, the presence of this compound in groundwater needs to be defined. No other HSL organics, pesticides, herbicides, or PCBs were identified in groundwater downgradient of the landfill.

Mercury was detected at 7.5 µg/l in one of four replicate samples from JMW-108. The fact that detectable mercury was not found in the other downgradient wells or in the three other replicates from JMW-108 suggests that the mercury is a possible artifact. The presence of mercury requires confirmation. No other significant metals contamination was observed downgradient of the landfill.

13.1.4 Surface Water

The surface water sample collected in the drainageway from the pesticide pit contained 0.57 µg/l 4,4'-DDT. As indicated in the preceding paragraphs, the sediments of this shallow pond also contained DDT residues. Because of its strong sorptive properties, it is likely that the observed DDT in surface water is predominantly bound to suspended particulate matter. These data indicate the migration of chlorinated pesticide residues by surface water transport. Except for methylene chloride, considered to be a laboratory contaminant and not site-related, no HSL VOCs or SVOCs were observed in the surface water. Arsenic, barium, copper, and zinc were identified at levels below the CRDL. Because of the turbid nature of the samples, these metals are likely related to the suspended particulate matter as a component of the civil matrix from the site, based on the analysis of metals content in site soils.

13.2 RECOMMENDATIONS

- o Because of the potential for recharge conditions from the till into the bedrock, and the presence of VOCs in the monitoring wells immediately downgradient of the landfill, Jordan recommends that additional multi-level monitoring wells be installed in the bedrock, farther downgradient from JMW-107, JMW-108, and JMW-109.
- o Jordan recommends resampling the existing monitoring wells, sampling the new (proposed herein) monitoring wells, and analyzing the groundwater for

inorganic compounds, VOCs and SVOCs, pesticides, PCBs, organophosphorus pesticides, chlorinated herbicides, chloride, fluoride, sulfate, and pH. Because of the VOC trace levels observed, additional analyses for these chemicals should be performed using more sensitive GC methods.

- o Because of the migration of pesticides to the ponded area northeast of the landfill boundary, Jordan recommends that additional surface soil/sediment samples be collected from: (1) the areas east and downgradient of the JSD-100 sample location (ponded area); (2) on the landfill surface in the vicinity of the pesticide burial pit; and (3) between the pit and ponded area. These samples should be analyzed for chlorinated and organophosphate pesticides, herbicides, and PCBs.
- o A limited soil/sediment sampling program should be performed to further assess the presence and extent of PAHs.
- o Jordan recommends that a Baseline Environmental Risk Assessment be performed for the site.

GLOSSARY OF ACRONYMS

ACL	Alternate Concentration Limit
ANG	Air National Guard
ANGB	Air National Guard Base
AP	Airport
ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
BEHP	Bis(2-ethylhexyl)phthalate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEARS	Cornell Laboratory for Environmental Applications of Remote Sensing
CLP	Contract Laboratory Program
CLP-CIP	Contract Laboratory Program Caucus Inorganic Protocol
CLP-COP	Contract Laboratory Program Caucus Organic Protocol
CRDL	Contract Required Detection Limit
CWA	Clean Water Act
DWEL	Drinking Water Equivalent Level
FTA	Fire Training Area
GC	gas chromatography
gpm	gallons per minute
HSL	Hazardous Substance List
I	Industrial
IB	Interchange Business
IDL	Instrument Detection Limit
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MS	Mass Spectrometry
NCP	National Contingency Plan
NHAP	National High Altitude Photograph
NPL	National Priority List
NUS	NUS Corporation
NYANG	New York Air National Guard
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
OLI	Office and Light Industrial

PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PI	Photoionization; Planned Industrial
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SVOCs	Semivolatile Organic Compounds
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
USMA	U.S. Military Academy
VOCs	Volatile Organic Compounds

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